RECORD OF DECISION
for
OPERABLE UNIT 2
FORT WAINWRIGHT
FAIRBANKS, ALASKA

3.2.2

1/97

January 1997

DECLARATION STATEMENT
for
RECORD OF DECISION
FORT WAINWRIGHT
FAIRBANKS, ALASKA
OPERABLE UNIT 2
JANUARY 1997

SOURCE AREA NAME AND LOCATION

Operable Unit 2
Fort Wainwright
Fairbanks, Alaska

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the selected remedial actions for Operable Unit 2 (OU-2) at Fort Wainwright in Fairbanks, Alaska. OU-2 originally consisted of eight source areas: the Defense Reutilization and Marketing Office (DRMO) Yard, the Building 1168 Leach Well, the North Post Site, the 801 Drum Burial Site, the Engineers Park Drum Site, the Drum Site South of the Landfill, Building 3477, and the Tar Sites. This ROD was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986 and 42 United States Code 9601 et seq., and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan and 40 Code of Federal Regulations 300 et seq. This decision is based on the Administrative Record for this OU.

The United States Army, the United States Environmental Protection Agency, and the State of Alaska, through the Alaska Department of Environmental Conservation, have agreed to the selected remedies.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the DRMO Yard and Building 1168 Leach Well source areas, if not addressed by implementing the response actions selected in this ROD, may present a substantial endangerment to public health, welfare, or the environment. Specific hazardous substances in the soil and groundwater at the DRMO Yard and Building 1168 Leach Well include benzene, tetrachloroethene, trichloroethene, and petroleum by-products.

DESCRIPTION OF THE SELECTED REMEDIES

This is the third OU to reach a final-action ROD at this National Priorities List site. This ROD addresses soil and groundwater contamination at OU-2.

The 801 Drum Burial Site, Engineers Park Drum Site, and Drum Site South of the Landfill were assigned to the Fort Wainwright OU-1 investigation and will be addressed through the

OU-1 decision process. No further action is selected for Building 3477 and the Tar Sites. The contaminated soils at the North Post Site were addressed adequately through an Army removal action; it is anticipated that this will constitute final action for the North Post Site. Therefore, no analysis of remedial alternatives was conducted for these source areas. The documents recommending these actions are included in Appendix A.

The remedial action objectives for the DRMO Yard and Building 1168 Leach Well are designed to:

- Restore groundwater to drinking water quality;
- Prevent further leaching of contaminants into groundwater;
- Reduce or prevent further off-site migration of contaminated groundwater; and
- Prevent use of groundwater above federal Safe Drinking Water Act and State of Alaska Drinking Water Standards (18 Alaska Administrative Code 80) maximum contaminant levels (MCLs).

The major components of the remedies at both source areas are:

- In situ soil vapor extraction and air sparging of the groundwater to reduce volatile organic compounds to a level that meets state and federal MCLs;
- Institutional controls that would include restrictions on groundwater well installations, site access restrictions, and maintenance of fencing at the DRMO Yard until state and federal MCLs are met;
- Additional institutional controls, including a limitation on refilling the DRMO Yard fire suppression water tank from the existing potable water supply well, until state and federal MCLs are met (except in emergency situations); and
- Natural attenuation to attain Alaska Water Quality Standards after reaching state and federal MCLs.

STATUTORY DETERMINATION

The selected remedial actions are protective of human health and the environment, comply with federal and state requirements that are legally applicable or relevant and appropriate to the remedial actions, and are cost-effective.

The remedies utilize permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfy the statutory preference for remedies that employ

treatment that reduces toxicity, mobility, or volume (of contaminated media) as a principal element.

Because these remedies will result in hazardous substances at concentrations remaining above regulatory levels at these source areas, a policy review will be conducted within five years after commencement of the remedial action to ensure that the remedies continue to provide adequate protection of human health and the environment.

SIGNATURES

Signature sheet for the foregoing Operable Unit 2, Fort Wainwright, Record of Decision between the United States Army and United States Environmental Protection Agency, Region 10, with concurrence by the Alaska Department of Environmental Conservation.

27 March 1997

WILLIAM M. STEELE
Lieutenant General, USA
Commanding

Date

SIGNATURES

Signature sheet for the foregoing Operable Unit 2, Fort Wainwright, Record of Decision between the United States Army and United States Environmental Protection Agency, Region 10, with concurrence by the Alaska Department of Environmental Conservation.

Chuck Clarke

Chuck Clarke
Regional Administrator, Region 10
United States Environmental Protection Agency

3-31-97

Date

SIGNATURES

Signature sheet for the foregoing Operable Unit 2, Fort Wainwright, Record of Decision between the United States Army and United States Environmental Protection Agency, Region 10, with concurrence by the Alaska Department of Environmental Conservation.

Kurt Fredriksson
Director, Spill Prevention and Response
Alaska Department of Environmental Conservation

Date

TABLE OF CONTENTS

LIST OF TABLES

List of Tables (Cont.)

LIST OF ILLUSTRATIONS

DECISION SUMMARY

RECORD OF DECISION
for
OPERABLE UNIT 2
FORT WAINWRIGHT
FAIRBANKS, ALASKA
JANUARY 1997

This decision summary provides an overview of the problems posed by the contaminants at Fort Wainwright, Operable Unit 2 (OU-2), source areas. This summary describes the physical features of the site, the contaminants present, and the associated risks to human health and the environment. The summary also describes the remedial alternatives considered; provides the rationale for the remedial actions selected; and states how the remedial actions satisfy the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) statutory requirements.

The United States Army (Army) completed a Remedial Investigation (RI) to provide information regarding the nature and extent of contamination in the soils and groundwater. A Baseline Human Health and Ecological Risk Assessment was developed and used in conjunction with the RI to determine the need for remedial action and to aid in the selection of remedies. A Feasibility Study (FS) was completed to evaluate remedial options.

1.0 SITE DESCRIPTION

1.1 SITE LOCATION AND DESCRIPTION

Fort Wainwright, also referred to as *the site*, occupies 915,000 acres on the east side of Fairbanks, Alaska. Fort Wainwright originally was established in 1938 as a cold weather testing station. During World War II, it served as a crew transfer point in the United States-Soviet Union Lend-Lease Program. After the war, it became a resupply and maintenance base for remote experimental stations in the Arctic Ocean and remote Distant Early Warning sites throughout Alaska. In 1961, Fort Wainwright was transferred to the Army.

Current primary missions at Fort Wainwright include training of infantry soldiers in the arctic environment, testing of equipment in arctic conditions, preparation of troops for defense of the Pacific Rim, and rapid deployment of troops worldwide. On-site industrial activities include use and maintenance of fixed-wing aircraft, helicopters, vehicles, and support activities. Fort Wainwright includes the main post area, two range complexes, and two maneuver areas.

OU-2 originally consisted of the following eight source areas: the North Post Site, the 801 Drum Burial Site, the Engineers Park Drum Site, the Drum Site South of the Landfill, Building 3477, four Tar Sites, the Defense Reutilization and Marketing Office (DRMO) Yard, and the Building 1168 Leach Well. All OU-2 source areas have undergone Preliminary Source Evaluations, which include historical record reviews and, if necessary, limited field investigations. These investigations determined whether a source area should be referred to another federal or state program or another OU, recommended for no further action (NFA), or included in the CERCLA remedial investigation. Petroleum contamination can be addressed in the Two-Party Agreement between the State of Alaska and the Army.

The Chena River flows through Fort Wainwright and the City of Fairbanks, into the Tanana River. Figure 1-1 illustrates the entire installation and each source area's location. All source areas are in a 500-year floodplain, except for the North Post and Engineers Park Drum Sites, which are in the 100-year floodplain. No threatened or endangered species reside in the area. Small ponds and wetlands are adjacent to the DRMO Yard. No known historic sites are associated with the source areas.

1.1.1 801 Drum Burial Site

The 801 Drum Burial Site is in an undeveloped depression between River Road and the Chena River, approximately 0.13 mile east of the 801 military housing area. This source area is shown in Figure 1-1.

This source area was assigned to the Fort Wainwright OU-1 investigation and will be addressed through the OU-1 decision process. The decision document recommending this action is included in Appendix A. Therefore, the 801 Drum Burial Site source area will not be discussed further in this Record of Decision (ROD).

1.1.2 Engineers Park Drum Site

The source area location is shown in Figure 1-1. The Engineers Park Drum Site is located on the northeast side of Engineers Park, on the south bank of the Chena River. Drum disposal reportedly began at this source area after the 1967 Chena River flood.

This source area was assigned to the Fort Wainwright OU-1 investigation and will be addressed through the OU-1 decision process. The decision document recommending this action is included in Appendix A. Therefore, the Engineers Park Drum Site source area will not be discussed further in this ROD.

1.1.3 Drum Site South of the Landfill

The Drum Site South of the Landfill is located 2,000 feet south of the Fort Wainwright Landfill, as shown in Figure 1-1. Historical information and records regarding drum disposal at this source area are not available. This site was identified as a potential source in the Resource Conservation and Recovery Act (RCRA) Facility Assessment conducted in 1988.

This source area was assigned to the Fort Wainwright OU-1 investigation and will be addressed through the OU-1 decision process. The decision document recommending this action is included in Appendix A. Therefore, the Drum Site South of the Landfill will not be discussed further in this ROD.

1.1.4 Building 3477

Building 3477 is located on Chippewa Avenue, approximately 0.25 mile northeast of the South Gate Road Gate House (see Figure 1-1). Building 3477 was constructed as a vehicle maintenance facility in 1955 and is being used for vehicle and equipment maintenance. Batteries were serviced and stored at the site for an unknown period of time. In 1990, the Army discontinued this practice and contracted for cleaning the battery service area. Storage of old batteries continued along the east side of the building until they were disposed of.

Site investigations that included sampling and analysis of soil and groundwater in 1992 indicated that the source area was no longer being used for battery storage. Concentrations of suspected contaminants were below the United States Environmental Protection Agency's (EPA's) Region 3 risk-based screening levels based on residential land use. EPA, Region 10, *Supplemental Risk Assessment Guidance* recommends use of EPA, Region 3, risk-based screening criteria.

NFA is recommended for Building 3477 under CERCLA. This recommendation is recorded in the decision document included in Appendix A. The Building 3477 source area will not be discussed further in this ROD.

1.1.5 Tar Sites

The Tar Sites are in four locations: west of the South Post soccer field, on Southgate Road on the former South Post parade field; at Glass Park next to Building 4040; northwest of the Post Golf Course on the north bank of the Chena River; and west of the Post Power Plant

cooling pond next to the railroad (see Figure 1-1). These locations generally are covered by soil and vegetation.

The Tar Sites reportedly were used as tar disposal areas. An investigation conducted in June and July 1992 indicated that the analyzed tar samples have no potential to leach to groundwater. These results indicate that the Tar Sites should be addressed as a solid waste or through recycling/reuse. NFA is recommended for the Tar Sites under CERCLA. This recommendation is recorded in the decision document included in Appendix A. The Tar Sites source area will not be discussed further in this ROD.

1.1.6 Defense Reutilization and Marketing Office Yard

A detailed map of the DRMO Yard source area is depicted in Figure 1-2. The DRMO Yard is located along Badger Road, northwest of Badger Road and the Richardson Highway. The DRMO Yard source area is a fenced compound covering approximately 25 acres and containing seven buildings. The DRMO Yard contains numerous aisles of surplus appliances, tires, transformers, and wire. In addition, it serves as the hazardous material transfer point for Fort Wainwright, Fort Greely, and Eielson Air Force Base. The yard's function is to store obsolete, surplus, unserviceable equipment and supplies for transfer to another authorized user, for public auctions, or for destruction and disposal. Historical records of DRMO Yard activities were not maintained routinely. The DRMO Yard operates as a storage facility in accordance with the Fort Wainwright RCRA Part B Permit.

Approximately 200 feet east of the DRMO Yard source area is the Arctic Surplus site, a privately owned facility and a CERCLA National Priorities List (NPL) site. Many items formerly stored at the DRMO Yard were sold to Arctic Surplus.

1.1.7 Building 1168 Leach Well

A detailed map of the Building 1168 Leach Well source area is depicted in Figure 1-3. Building 1168 is located on the north side of Trainor Gate Road, adjacent to the Trainor Gate entrance and within approximately 200 feet of the Post boundary to Fort Wainwright. The Building 1168 Leach Well source area is surrounded by fenced storage yards on the north and east and by unrestricted parking lots on the south and west. Building 1168 is a single-story, 65-foot by 95-foot, lube oil and vehicle storage facility, equipped with a 2,000-gallon heating oil tank and a septic system for sanitary waste. A 10,000-gallon aboveground storage tank (AST) was located inside the southeast corner of the building. In 1958, the tank was removed and the area was converted to a petroleum, oil, and lubricant (POL) laboratory. Five floor drains were located in the west half of the building and were used to drain into an oil/water separator that emptied into a 250-gallon underground storage tank (UST) and a leach well. During summer 1995, the floor drains were filled and the UST and leach well were removed completely from service.

1.1.8 North Post Site

A detailed map of the North Post Site is depicted in Figure 1-4. The North Post Site covers approximately 45 acres and is located northwest of and adjacent to two military housing areas, on an oxbow of the Chena River.

In 1947, the Arctic Aeromedical Laboratory (AAL) began operating on the northwest portion of the source area. The laboratory conducted cold adaptation and acclimatization experiments for 20 years. In 1967, the facility was closed. In addition to AAL, several temporary buildings and a radio transmitter were located in the vicinity. The transmitter was most likely a base radio station. Historical photographs show that a slough of the Chena River separated the North Post Site source area from the main Post. This slough apparently was filled with construction debris during the 1940s and early 1950s.

The North Post Site was discovered during a 1985 geotechnical investigation for construction of a proposed housing development. The drilling crew noticed strong odors in soil borings on the west side of the oxbow area. Additional soil borings and wells were drilled, and petroleum and solvents were identified in the west portion of the oxbow. Additional sampling and evaluation occurred in 1986 and 1987 to investigate and delineate areas of potential contamination. An endangerment assessment was conducted to evaluate whether hazardous wastes were present and whether they presented a threat to human health.

While most of the site was found to be free of contamination, fuels, solvents, pesticides, and metals were identified in discrete locations within this source area. Additional samples were collected at these sites to further characterize contamination and to evaluate levels for the Baseline Risk Assessment.

Petroleum-contaminated soil was removed and treated by the Army in 1993. In situ groundwater treatment continues at one of the source areas under the jurisdiction of the Two-Party Agreement between the State of Alaska and the Army. During summer 1996, the Army conducted an additional removal action that included excavation, treatment, and proper disposal of soils containing fuel-related products. This is anticipated to be the final action for this source area. The final report on this removal action may be found in Appendix A. Therefore, the North Post Site will not be discussed further in this ROD.

1.2 SOILS AND GEOLOGY

Fort Wainwright is underlain by soil and unconsolidated sediment that consist of silt, sand, and gravel and range in thickness from 10 feet to more than 400 feet before encountering bedrock. A 5-foot-thick surficial soil layer of fine-grained soil overlies the deeper alluvial deposits. The surficial soil consists of varying proportions of sand and gravel, which generally are layered. At the base of Birch Hill and in areas adjacent to the Chena River, soil types are coarse-grained and have high percentages of sand and gravel. Within the shallow alluvial aquifer, predominant groundwater flow beneath Fort Wainwright is toward the Chena River.

1.3 HYDROGEOLOGY AND GROUNDWATER USE

The main aquifer in the Fort Wainwright area is the Tanana Basin alluvial aquifer in a buried river valley. This aquifer ranges from a few feet thick at the base of Birch Hill to at least 300 feet thick under the fort's main cantonment area. The aquifer may reach a thickness of 700 feet in the Tanana River valley. Groundwater in the Tanana-Chena floodplain generally is considered to be unconfined in permafrost-free areas. A confined aquifer may develop seasonally where the depth to the water table is less than the depth of the seasonal frost

penetration. The depth to groundwater varies and may range from 2 feet to 18 feet below ground surface (BGS) at OU-2 source areas.

Groundwater movement between the Tanana and Chena Rivers generally follows a northwest regional direction, similar to the flow direction of the rivers. The Chena River flows through Fort Wainwright and the City of Fairbanks, into the Tanana River. The Tanana River borders the south portion of Fort Wainwright. Flow probes near OU-2 source areas indicate seasonal changes in flow direction of up to 180 degrees. This is because of the effects of changing river stages in the Tanana River and, to a lesser extent, in the Chena River. Groundwater levels near the Chena River fluctuate greatly because of river stage and interactions with the Tanana River. Typically, groundwater levels rise when the river stage increases, particularly during spring breakup and the late summer runoff. Groundwater levels usually drop during fall and winter, when precipitation becomes snow. During winter, groundwater seeps into surface water bodies, such as the Chena River, and produces overflow ice. In addition to shifts in the groundwater flow direction due to the surface water hydrology, the groundwater flow direction may be impacted by high-volume pumping at off-post gravel pits for dewatering activities.

Where present, permafrost forms discontinuous confining layers that influence groundwater movement and distribution. The depth to permafrost, when present, ranges from 2 feet to 40 feet BGS. The greater depths are found on cleared and developed land surfaces, where thermal degradation of underlying permafrost occurs.

Groundwater is the only source of potable water used at Fort Wainwright and the Fairbanks area. Approximately 95% of Fort Wainwright's potable water is supplied through a single distribution system which is normally fed by two large-capacity wells located in Building 3559, near the Post Power Plant (see Figure 1-5). These wells were completed at a depth of approximately 80 feet and provide between 1.5 million and 2.5 million gallons of water to the Post Water Treatment Plant for processing and distribution.

In addition to the main drinking water supply wells, there are five emergency standby supply wells located around the cantonment area. These wells have been completed between 80 feet and 120 feet and are capable of pumping approximately 250,000 gallons per day per well. These wells, if used in an emergency, will supply minimally treated water to Fort Wainwright's main drinking water supply system.

During summer 1996, a potable water supply/fire suppression well was installed in the DRMO Yard, 50 feet upgradient of the defined solvent plume and 100 feet downgradient of a defined petroleum plume. Associated with the fire suppression system is a 400,000-gallon tank. To prevent hydraulic movement of the adjacent plumes, the *State of Alaska Plan Approval to Construct* stipulated a pumping rate limitation of 60 gallons per minute. Additionally, contract restrictions required that initial filling of the storage tank be done with tank trucks rather than from the DRMO Yard aquifer. A granulated activated carbon treatment system was installed for the drinking water supply to remove taste, odor, and potential contaminants of concern.

Residential developments that utilize private wells for domestic water supply are close to the DRMO Yard and Building 1168 Leach Well source areas. Some of these private wells near

the DRMO Yard are contaminated with solvents and petroleum products. The DRMO Yard is not considered the source of these contaminants. Federal and state regulatory agencies are investigating several locations, not associated with Fort Wainwright, that were identified as potential sources of this contamination.

The City of Fairbanks uses the same aquifer and has four developed Municipal Utility System wells located 1 mile downgradient of the Post's boundaries, on the banks of the Chena River. These wells serve as the main drinking water supply for most of the City of Fairbanks.

1.4 LAND USE

Current land use for the OU-2 source areas is light industrial. Although no residences are located on any source area, residential developments are close to the DRMO Yard and Building 1168 Leach Well source areas. Domestic water use occurs at one OU-2 source area: the DRMO Yard. Groundwater in the aquifer under these source areas is the sole source of drinking water for Fort Wainwright and the City of Fairbanks. Operations at the DRMO Yard and Building 1168 Leach Well are expected to continue indefinitely. Access is unrestricted to OU-2 source areas, except for the DRMO Yard.

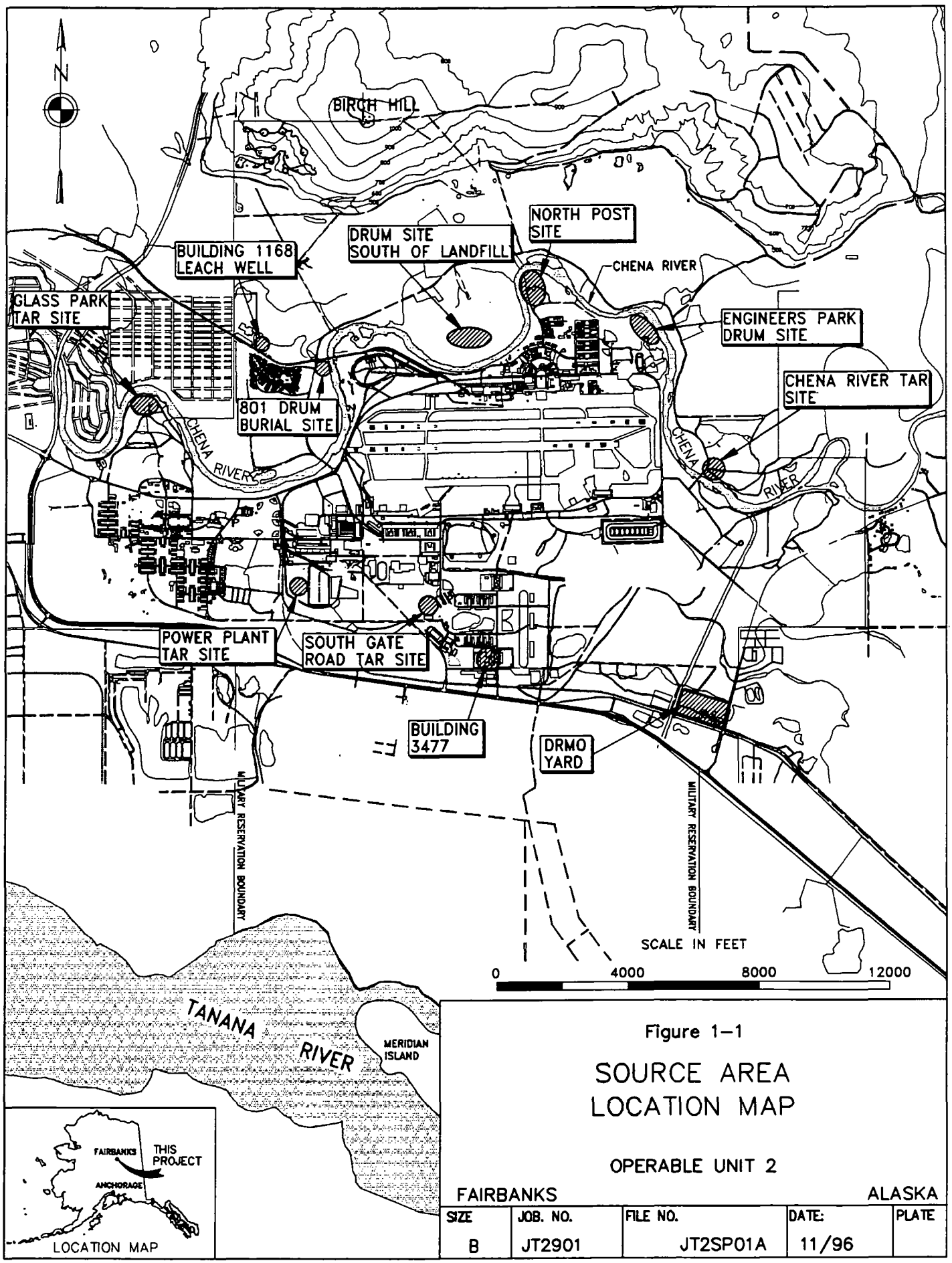

Figure 1–1

SOURCE AREA LOCATION MAP

OPERABLE UNIT 2

FAIRBANKS ALASKA

SIZE	JOB. NO.	FILE NO.	DATE:	PLATE
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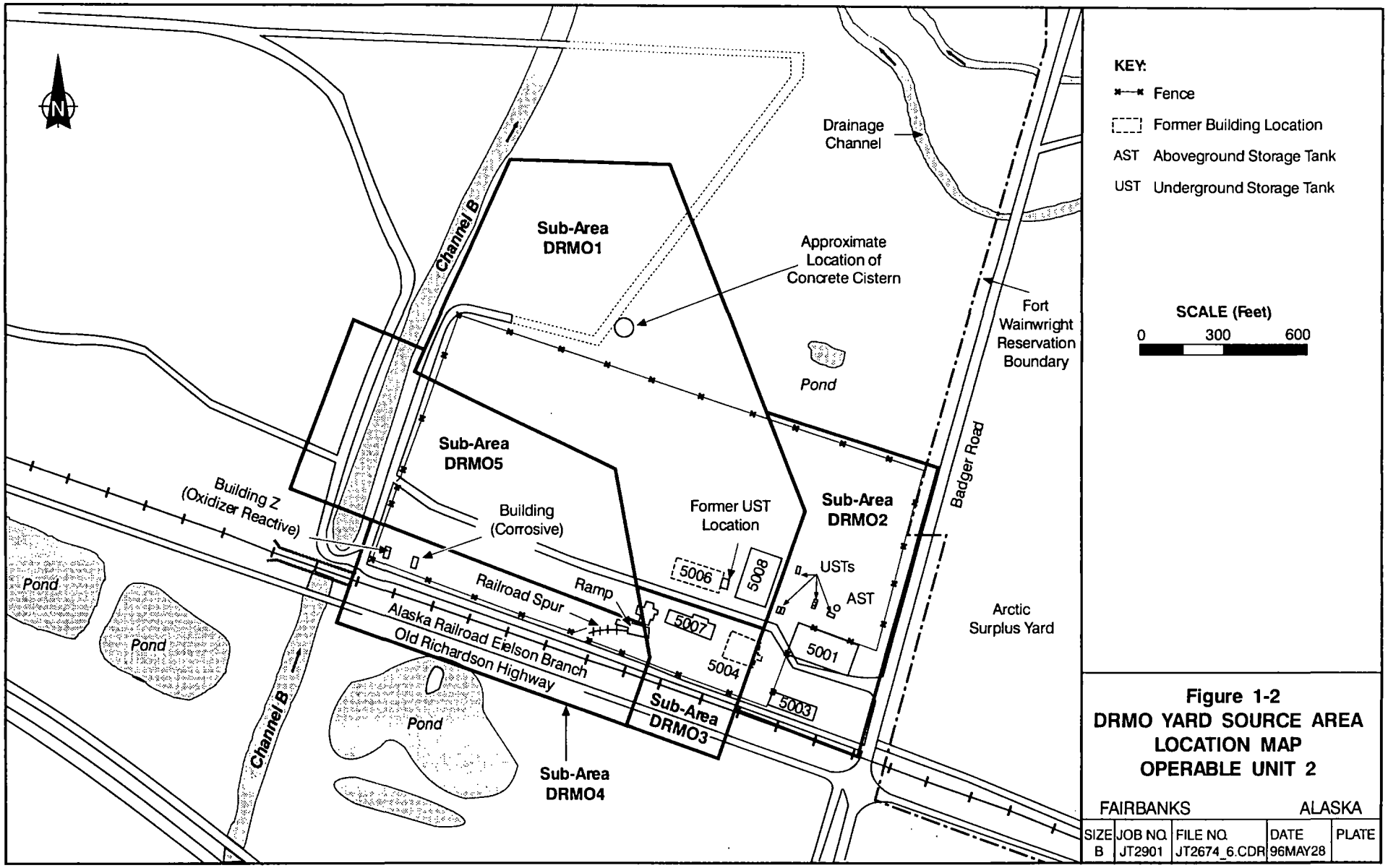

Figure 1-2
DRMO YARD SOURCE AREA LOCATION MAP
OPERABLE UNIT 2

FAIRBANKS ALASKA

SIZE	JOB NO.	FILE NO.	DATE	PLATE
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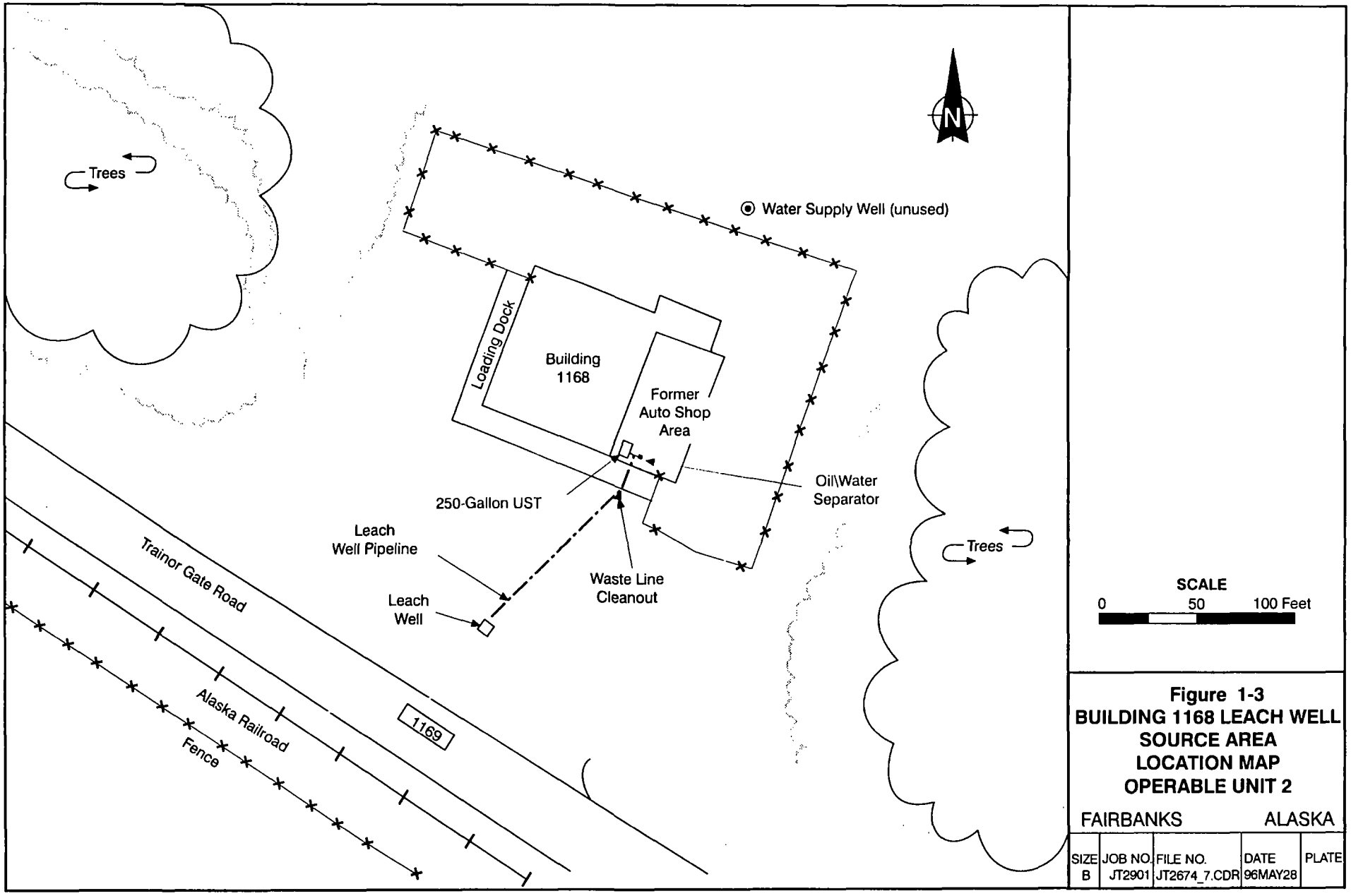

Figure 1-3
BUILDING 1168 LEACH WELL SOURCE AREA LOCATION MAP OPERABLE UNIT 2

FAIRBANKS ALASKA

SIZE	JOB NO.	FILE NO.	DATE	PLATE
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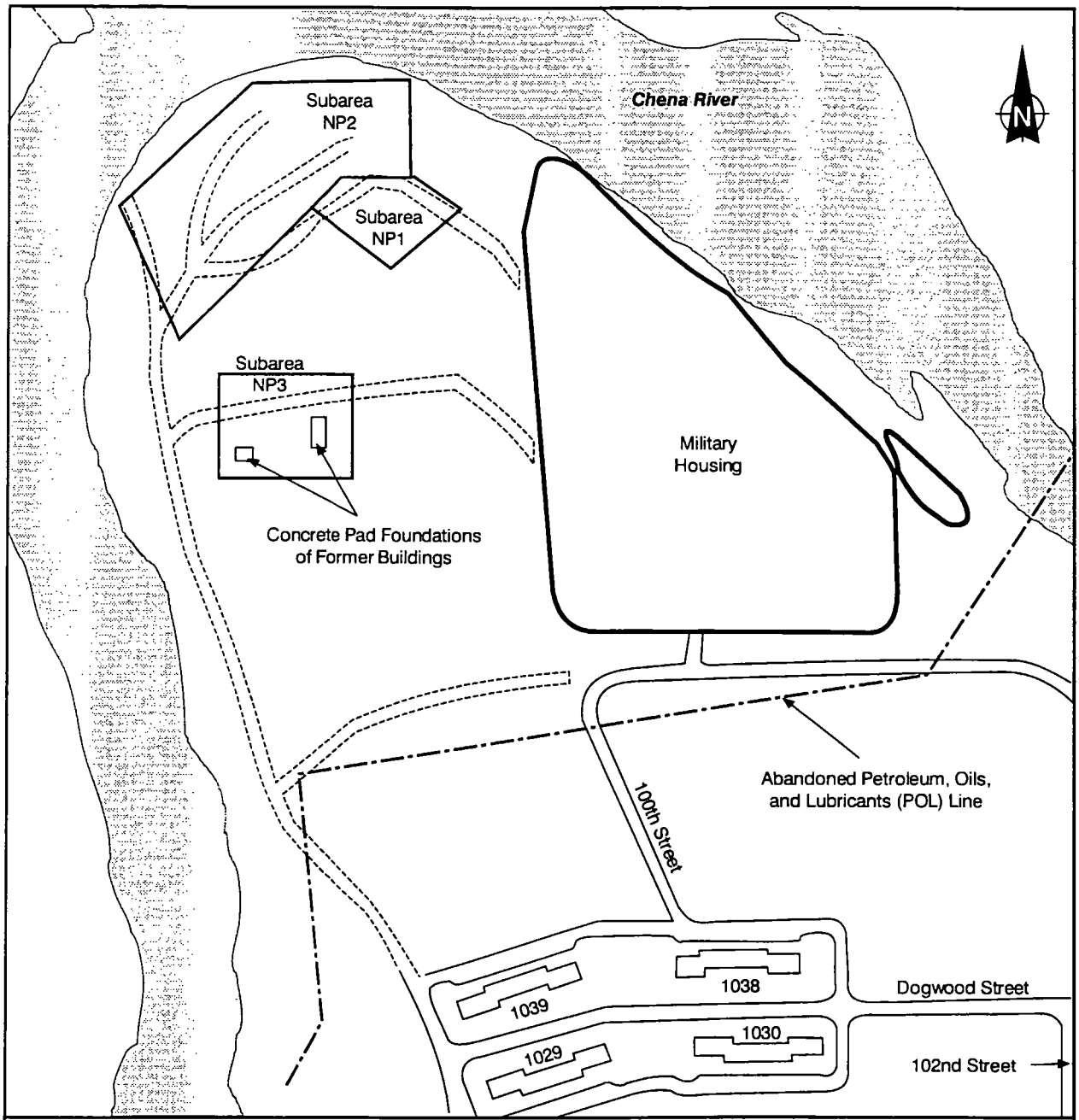

SCALE
0 300 600 Feet

Figure 1-4
NORTH POST SITE SOURCE AREA
LOCATION MAP
OPERABLE UNIT 2

FAIRBANKS ALASKA

SIZE	JOB NO.	FILE NO.	DATE	PLATE
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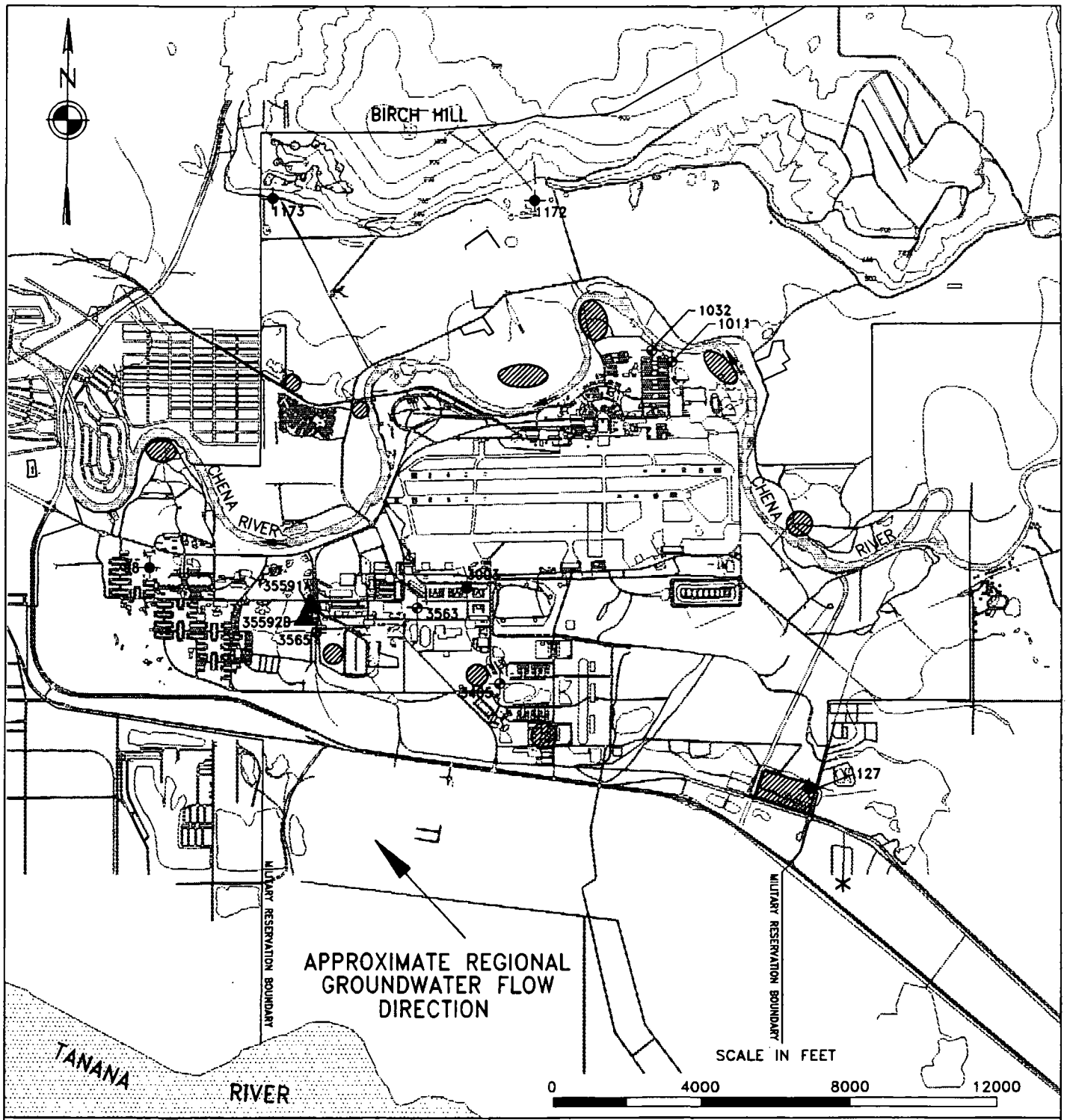


LEGEND

- 127 SEPARATE DRINKING WATER SUPPLY WELL
- 1032 EMERGENCY STANDBY WATER SUPPLY WELL
- 35591A MAIN DRINKING WATER SUPPLY WELL
- SOURCE AREA LOCATIONS (SEE FIG. 1-1)
- FLOW DIRECTION
- GREATER THAN 70 PRIVATE DRINKING WELLS IN 6-MILE VILLAGE SUBDIVISION
- CONTOURS

LOCATION MAP

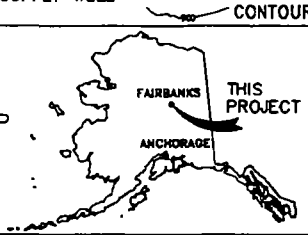


Figure 1-5

WATER SUPPLY WELL MAP

OPERABLE UNIT 2

FAIRBANKS ALASKA

SIZE	JOB. NO.	FILE NO.	DATE:	PLATE
B	JT2900	JT2S004A	11/96	

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 SITE HISTORY

The DRMO Yard and Building 1168 Leach Well source areas have limited documents available to describe past practices. However, most source areas underwent evaluations, including sampling and analyses, before the RI. The source areas were listed as hazardous waste sites requiring further evaluation in the RCRA Facility Assessment.

2.1.1 Defense Reutilization and Marketing Office Yard

From 1945 to 1961, the DRMO Yard was used for vehicle storage and contained a vehicle maintenance shop. In 1961, the source area was converted into a salvage yard and was used to store drums of waste oil; pesticides; solvents; vehicle fluids such as antifreeze and hydraulic fluid; asphalt; and electrical transformers, some of which may have contained polychlorinated biphenyls (PCBs). Many drums reportedly leaked. Items such as mattresses, wood furniture, and possibly plastics were incinerated routinely in a burn pit. It is likely that the drummed fluids also were disposed of by burning. Waste oil, which historically contained heavy metals, solvents, PCBs, and other contaminants, was used to control dust on roads in the DRMO Yard during the 1970s and early 1980s. During the early 1980s, an estimated 3,000 gallons to 8,000 gallons of No. 1 diesel fuel were spilled near the former location of Building 5001. Cleanup included spreading the contaminated soil throughout the yard. Storage and destruction records were maintained by DRMO Yard personnel for three years and then were destroyed. Consequently, complete records of DRMO Yard activities are unavailable.

From 1988 to 1996, eight leaking underground petroleum storage tanks, ranging in size from 500 gallons to 10,000 gallons, were removed from the DRMO Yard. Cleanup of the associated petroleum-contaminated soil and groundwater is being conducted under the Two-Party Agreement.

From 1990 through 1993, investigations including geophysical surveys, surface and subsurface soil sampling, and installation of groundwater monitoring wells were conducted to identify the extent of contamination at the DRMO Yard.

The DRMO Yard serves as the permitted hazardous material transfer point for Fort Wainwright, Fort Greely, and Eielson Air Force Base.

2.1.2 Building 1168 Leach Well

Building 1168 was constructed as a lube oil and vehicle storage facility in 1949 and was converted into a petroleum test laboratory in 1962. The building contained a 10,000-gallon lube oil AST, oil/water separator system, 250-gallon UST that discharged to the leach well, 2,000-gallon heating oil UST, and septic system for sanitary waste. Contaminant and water mixtures apparently entered floor drains, passed through the oil/water separator, and flowed into the leach well that serviced the building. Contaminants suspected to have entered the floor drains include engine and transmission oil, gasoline, diesel, jet fuel, solvents, hydraulic fluid, and engine coolants.

As-built drawings from 1962 indicate that the room housing the 10,000-gallon AST was converted into a POL laboratory. The 10,000-gallon tank was removed, and a new floor and floor drain system were installed.

In 1985, the Post utility maintenance group replaced the waste line from Building 1168 to the leach well. The workers did not report any stained soil or odors; however, they reportedly felt light-headed when working near the connection to the leach well.

Numerous investigations occurred at the Building 1168 Leach Well before the start of the RI. From 1990 through 1993, investigations including geophysical surveys, surface and subsurface soil sampling, and installation of groundwater monitoring wells were conducted to identify the extent of contamination at the Building 1168 Leach Well.

In 1990, a groundwater survey conducted by the United States Army Environmental Hygiene Agency and a RCRA Facility Assessment conducted by EPA recommended further investigation at the Building 1168 Leach Well. This recommendation was based on the high potential for releases via the leach well and UST.

In 1994, a pilot-scale remediation system was installed around the leach well to determine whether an in situ treatment system was technically feasible in source area soils because the contamination is located mainly in subsurface soils and groundwater. Progress reports have shown that the soil vapor extraction (SVE)/air sparging (AS) system has been very effective as a remediation technology at this source area.

2.2 ENFORCEMENT ACTIVITIES

Fort Wainwright was placed on the CERCLA NPL in August 1990. Consequently, a Federal Facilities Agreement (FFA) was signed by EPA, the Alaska Department of Environmental Conservation (ADEC), and the United States Department of Army in spring 1992. The FFA ensures that appropriate actions are taken to protect public health and the environment in accordance with state and federal laws. The FFA divided Fort Wainwright into five OUs, one of which is OU-2, and outlines the general requirements for investigation and/or remediation of suspected historical hazardous waste source areas associated with Fort Wainwright.

An additional goal of the FFA was to integrate the Army's CERCLA response obligations and RCRA corrective action obligations. Remedial actions implemented will be protective of human health and the environment such that remediation of releases shall obviate the need for further corrective actions under RCRA (i.e., no further corrective action shall be required for source areas).

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The public was encouraged to participate in the selection of the remedies for OU-2 during a public comment period from May 1 to May 31, 1996. The *Fort Wainwright Proposed Plan for Remedial Action, Operable Unit 2* presents more than 11 combinations of options considered by the Army, EPA, and ADEC to address contamination in soil and groundwater at OU-2. The Proposed Plan was released to the public on May 1, 1996, and was sent to 130

known interested parties, including elected officials and concerned citizens. An informational Fact Sheet dated March 1996, providing information about the Army's entire cleanup program at Fort Wainwright, was mailed to the same mailing list.

The Proposed Plan summarizes available information regarding OU-2. Additional materials were placed in two information repositories: one at the Noel Wien Library in Fairbanks and the other at the Fort Wainwright Post Library. An Administrative Record, including all items placed in the information repositories and other documents used in the selection of the remedial actions, was established in Building 3023 on Fort Wainwright. The public is welcome to inspect materials available in the Administrative Record and the information repositories during business hours. The Administrative Record index is provided in Appendix B.

Interested citizens were invited to comment on the Proposed Plan and the remedy selection process by mailing comments to the Fort Wainwright project manager, by calling a toll-free telephone number to record a comment, or by attending and commenting at a public meeting on May 8, 1996, at the Carlson Center Prow Room in Fairbanks. No official comments were received from the public during the comment period. Six people attended the public meeting.

Display advertisements in the *Fairbanks Daily News-Miner*, published on April 28 and May 1, 5, 6, 7, and 8, 1996, also include information regarding the information repositories, the toll-free telephone line, and an address for submitting written comments.

The Responsiveness Summary in Appendix C summarizes and addresses public comments on the Proposed Plan and the remedy selection process.

2.4 SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

As with many Superfund sites, the problems at Fort Wainwright are complex. OU-2 will be the third OU, following OU-3 and OU-4, at Fort Wainwright to have completed the RI/FS process and to begin remedial action activities. The OU-2 RI and FS were performed in accordance with the RI/FS Management Plan for OU-2. The RI fieldwork was conducted during summer 1993. The final RI, Data Validation Review, Risk Assessment, and FS reports were submitted to EPA and the State of Alaska in January, September, and October 1995 and April 1996, respectively.

This ROD presents the selected remedial action for OU-2 chosen in accordance with CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The decision for OU-2 is based on the Administrative Record.

The remedial actions described in this ROD address threats to human health and the environment posed by the contamination at OU-2. The RI/FS has defined potential risks posed by existing groundwater contamination and the potential for migration if remediation does not occur.

3.0 SUMMARY OF SOURCE AREA CHARACTERISTICS

Physical features, hydrogeologic conditions, and the nature and extent of contamination for the DRMO Yard and Building 1168 Leach Well source areas are described briefly in the following sections.

3.1 DEFENSE REUTILIZATION AND MARKETING OFFICE YARD

3.1.1 Physical Features, Hydrogeologic Conditions, and Transport Pathways

The topography at the DRMO Yard source area grades gently to the north and northwest. However, numerous depressions and the presence of silty soil may promote surface water ponding. Surface water runoff from the northeast portion of the source area drains east to a drainage ditch, adjacent to Badger Road, that eventually drains into the Chena River. Surface water runoff from the west half of the source area may enter Channel B, a man-made, riprapped conveyance that parallels the west boundary of the DRMO Yard and connects the Chena and Tanana Rivers. Flow is predominantly toward the Chena River, approximately 1 mile away.

A shallow stream bed located north of the DRMO Yard source area may serve as a channel for surface water runoff to the Chena River during spring breakup and heavy precipitation. A small pond is located 150 feet north of the DRMO Yard; however, the pond does not discharge into a well-defined surface drainage system and the relationship of the pond to groundwater is unknown.

At the DRMO Yard, surface soil can be characterized as fill material, 3 feet to 6 feet deep, consisting of silt, silty sands, and gravels. Subsurface soil at the DRMO Yard is variable and consists of layers of unconsolidated silty sand, gravel, silt, and alluvial deposits of sand and gravel.

Contaminants were detected in surface soil, subsurface soil, sediment, surface water, and groundwater at the DRMO Yard.

Contaminants in surface soil are available to migrate via surface runoff. Although the DRMO Yard is relatively flat, nearby ponds and drainage ditches may receive contaminated runoff from the site. Contaminated runoff from the DRMO Yard would be deposited in sediments. Dissolved contaminants in runoff may be transported through the system of drainage channels and streams in and around the source area to the Chena River. Contaminants in surface soil also can migrate via infiltration to subsurface soil through the downward percolation of precipitation and snowmelt. The extent of contaminant infiltration into subsurface soil depends on the affinity of specific contaminants to adsorb or complex with soil particles. Surface soil contamination also can migrate from the DRMO Yard via particulate transport and volatilization; however, this migration pathway is considered relatively minor because of the six-month snow cover in the Fairbanks area.

Contaminants in subsurface soil are available to migrate downward through percolation to groundwater, caused by infiltration of precipitation and snowmelt. Volatile subsurface soil contaminants also can migrate upward to the surface through volatilization.

Groundwater is encountered at approximately 7.5 feet BGS in an unconfined drinking water aquifer consisting of poorly graded, coarse-grained deposits of sand and gravel. Groundwater generally flows west to northwest toward Channel B, which was constructed as part of the Chena River flood control project that connects the Chena and Tanana Rivers. Changes in flow direction in Channel B occur frequently and are attributable to water level changes in the Chena and Tanana Rivers. This change may result in Channel B recharging groundwater near the DRMO Yard. However, fluctuations in flow direction occur frequently and are attributable to water level changes in the Chena and Tanana Rivers.

Dissolved contaminants in groundwater will migrate through advective forces, influenced by horizontal and vertical groundwater flow gradients. Contaminated groundwater migrating from the DRMO Yard area eventually may be discharged to Channel B or to the drainage channel located north of the DRMO Yard (see Figure 1-3).

Residents in three nearby subdivisions use groundwater as a drinking water source. These private wells are located upgradient of the DRMO Yard, in the same unconfined aquifer as the identified DRMO Yard groundwater contamination. Groundwater generally flows west to northwest, away from these residential areas; however, fluctuations in flow direction occur. The first residential area is approximately 1,400 feet to the north, the second is approximately 1,000 feet to the northeast, and the third is approximately 400 feet to the southeast. A public drinking water well and fire suppression system were installed in 1996 and are in service within the fenced DRMO Yard. This well was installed directly upgradient of the known groundwater solvent contamination plume, at a depth of 102 feet. The solvent plume extends from approximately 7 feet BGS to between 30 feet and 40 feet BGS. Pumping rates at the public drinking water well will be limited until federal Safe Drinking Water Act and State of Alaska Drinking Water Standard maximum contaminant levels (MCLs) are achieved in the contaminant plume to reduce the chance of changing plume characterization and of causing the plume to be drawn within the cone of influence of the potable water well.

3.1.2 Nature and Extent of Contamination

From 1990 through 1993, investigations including geophysical surveys, surface and subsurface soil sampling, and installation of groundwater monitoring wells were conducted to identify the extent of contamination at the DRMO Yard.

In July 1992, 12 borings and two monitoring wells were installed in an area north of Building 5001 at the DRMO Yard as part of a geotechnical investigation for placing a building foundation. Petroleum hydrocarbons that exceeded ADEC's soil cleanup levels were detected in the soils. Groundwater in one monitoring well contained trichloroethene (TCE) at 8.6 parts per billion (ppb). The state and federal MCL for TCE is 5 ppb. A petroleum UST was associated with the most significant contamination at this source area, which is being remediated under the Two-Party Agreement.

Additional areas of soil and groundwater contamination at the DRMO Yard were investigated through a Preliminary Source Evaluation at the DRMO Yard in September 1992. The evaluation confirmed results from previous investigations conducted in the vicinity of and in the DRMO Yard. Petroleum hydrocarbons and volatile organic compounds (VOCs) associated with fuels and low levels of dioxins/furans, PCBs, and pesticides were detected in

soils and groundwater.

In 1993, the OU-2 RI was conducted. The main objectives at the DRMO Yard were to verify information about the nature and extent of surface and subsurface soil and groundwater contamination and to collect information of sufficient quality to be used in a Baseline Risk Assessment. The field investigation consisted of the following tasks: a geophysical survey, surface and subsurface soil sampling, installation of groundwater probes and monitoring wells, collection of groundwater samples, surface water and sediment sampling, and aquifer testing.

Contaminants detected in soil, groundwater, and sediments included organic compounds; i.e., petroleum hydrocarbons, PCBs, polynuclear aromatic hydrocarbons, chlorinated VOCs, dioxins, and pesticides. Several inorganic elements also were detected; i.e., manganese, lead, and arsenic (see Tables 3-1 through 3-5). These contaminants are believed to have come from several on-site sources, including former petroleum USTs; on-site storage of electrical transformers and drums without secondary containment; and the incineration of mattresses, wood furniture, drummed fluids, and plastics in an on-site fire burn pit. These contaminants were compared to existing background levels determined for inorganics in this mineral-rich area, screened for inclusion in the Human Health and Ecological Risk Assessment, and compared to state and federal drinking water standards. Analytes were retained as contaminants of concern if they exceeded background levels, standard risked-based screening criteria for residential exposure assumptions of 1×10^{-7} for soils and 1×10^{-6} for groundwater and a hazard index of 0.1, or state and federal MCLs. The levels of inorganics are attributable to elevated background concentration. No floating products (lighter-than-water nonaqueous phase liquids [LNAPLs]) or pure product solvents (denser-than-water nonaqueous phase liquids [DNAPLs]) were identified in the groundwater at the DRMO Yard.

This source was divided into six sub-areas. Sub-areas were used because of the size of the site, and to accurately characterize different types of suspected contaminants based on historical activities or known releases that had occurred. Planned remediation of source areas also is identified by sub-area.

The suspected sources of contaminants in the soil and groundwater at two sub-areas, DRMO2 and DRMO3, are removed USTs. Contaminants include petroleum and fuel products that exceed State of Alaska soil cleanup levels. Groundwater contamination included TCE and tetrachloroethene (PCE) at levels below state and federal MCLs.

Petroleum hydrocarbons in soil and groundwater at sub-area DRMO5 exceeded State of Alaska soil cleanup levels for UST petroleum-contaminated soil. This source area also contained PCBs at concentrations below action levels and one soil boring with dieldrin at a concentration of 1.0 milligrams per liter. A resampling event was conducted at this source area; five samples were collected in the vicinity of the positive dieldrin sample. The results were nondetect or less than screening levels. Because of the type of contaminants and suspected sources of contamination in DRMO2, DRMO3, and DRMO5, these source areas are being remediated under the Two-Party Agreement.

At sub-area DRMO1, two contaminants—PCE and TCE—were detected in the groundwater at levels above their state and federal MCLs of 5 ppb. A well-defined groundwater plume, with

maximum concentrations of 190 ppb and 17 ppb for PCE and TCE, respectively, has been identified. PCE has migrated to the northwest in the direction of the groundwater flow and extends beyond the DRMO Yard boundary, toward Channel B. The extent of the PCE plume is illustrated in Figure 3-1. TCE detected in groundwater and soil is likely a degradation product of PCE. The RI indicates that PCE-saturated soils above the groundwater plume are the source of groundwater contamination; however, soil contaminant levels were not found at concentrations that would result in the identified groundwater contaminant levels. The maximum depth of PCE in groundwater is between 30 feet and 40 feet BGS, with the highest concentration near the soil-water interface (7 feet BGS). This indicates that there is not a pure product DNAPL source in the aquifer. Shallow and fluctuating groundwater conditions contribute to the ongoing release of contaminants to groundwater. This is supported by the highest soil concentration found in the saturated vadose zone, possibly associated with subsurface releases from an abandoned wood stave pipe. Additionally, the groundwater plume isocontours and concentrations are indicative of a discrete defined subsurface source. While soil sampling in an approximate 75-foot grid in this area did not identify the source, the conceptual model supports its presence. The soils will be treated during in situ remediation at this site.

Benzo(a)pyrene was detected in three "hot spots" at sub-areas DRMO1 and DRMO4 (see Figure 3-1). Approximately 1,900 cubic yards of soil has been impacted by this compound. The source of the benzo(a)pyrene has not been identified, but the compound may be a by-product of the burning and drum storage activities within the "hot spot" areas at the source area. The maximum depth of detection was 2 feet BGS, indicating that the contaminant does not migrate readily through the soil column and is not a threat to groundwater.

At sub-area DRMO4, benzene and PCE in the groundwater exceed state and federal MCLs of 5 ppb (at 7.5 ppb and 51 ppb, respectively) and appear to originate from miscellaneous releases associated with operations occurring along a railroad spur. Soils contaminated with solvent and petroleum compounds are considered the source of groundwater contamination. The groundwater contamination is found at the southwest portion of the railroad spur and is isolated and small in size. Although only one groundwater sample exceeded the state and federal MCL for PCE and two samples exceeded the state and federal MCLs for benzene, a well-defined groundwater plume is present. The contamination begins at the southwest portion of the railroad spur and extends northwest to the road, from the west gate through the DRMO Yard (see Figure 3-2). Several other compounds were detected at concentrations below action screening levels in the soil and groundwater during the RI.

At sub-area DRMO6, sample detections included petroleum hydrocarbons and low levels of PCBs, dioxins, and inorganic elements; however, no contaminants attributable to activities associated with this sub-area exceeded screening levels. Sediment and surface water sample results will be evaluated further for potential contribution to cumulative ecological risk in the postwide Risk Assessment. No action is planned for this sub-area.

3.1.3 Defense Reutilization and Marketing Office Yard Summary

The petroleum-related contamination, including diesel-range organics (DRO) and gasoline-range organics (GRO) found in soil and groundwater throughout the source area, will be addressed through the Two-Party Agreement, except in areas where they are comingled with

other contaminants of concern. The PCE and TCE groundwater contaminant plumes underlie a sizable portion of sub-areas DRMO1 and DRMO4. Groundwater monitoring well contaminant levels in these source areas exceed state and federal MCLs for PCE and TCE at DRMO1 and for PCE and benzene at DRMO4. In addition, "hot spots" of benzo(a)pyrene were found in DRMO1 and DRMO4. A summary of analytical results for the DRMO Yard can be found in Tables 3-1 through 3-5.

3.2 BUILDING 1168 LEACH WELL

3.2.1 Physical Features, Hydrogeologic Conditions, and Transport Pathways

The topography at the Building 1168 Leach Well source area is relatively flat. No surface water drainage pathways are evident. During periods of high precipitation and spring snowmelt, surface water may flow overland to low-lying areas north and southeast of the site. The nearest surface water body, the Chena River, is approximately 1,800 feet to the east. The source area is surrounded by a spruce-hardwood forest to the west, north, and east.

Subsurface soil at the Building 1168 Leach Well source area consists of unconsolidated lenses of interlayered silt, silty sand, and poorly graded sand and gravel, underlain by sandy gravel. Fine-grained silt deposits appear as shallow lenses within silty sand and sand, and are overlain mostly by silty gravel. Silty, gravelly surface soil is predominantly fill material, likely laid down when the Building 1168 parking lot was constructed. Near surface sand and silt are underlain mainly by poorly graded, loose- to medium-density, saturated, sandy gravel that is highly permeable.

Contamination originated from a leach well that received liquids collected in floor drains within Building 1168. Floor drains were connected to a buried pipe that discharged to the leach well at approximately 13 feet BGS. Because of the release mechanism, significant surface soil contamination has not been identified at this source area. Floor drains within the building are suspected of receiving spilled oil and lubricants, fuels, solvents, and engine coolants. Contaminants in subsurface soil are available to migrate vertically toward groundwater with infiltration of precipitation and snowmelt. Lateral spreading of contaminants in subsurface soil has occurred from point sources of contamination because of capillary forces and partitioning exceeding gravitational forces on contaminant movement. Volatile contaminants in subsurface soil also can migrate upward through volatilization from groundwater to soil.

Infiltration and percolation through contaminated soil have been contributors to groundwater contamination. Leaching through contaminated soils caused by fluctuating groundwater levels and the affinity of petroleum products to float also have been major factors in continued groundwater contamination.

Groundwater is the main contaminant migration pathway at the Building 1168 Leach Well source area. Groundwater was encountered between 12 feet to 17 feet BGS and flows to the northwest toward the west boundary of Fort Wainwright and off-post residential areas. No confining layers have been encountered in the source area. Dissolved contaminants in groundwater will migrate through advective forces, influenced by horizontal and vertical groundwater flow gradients.

3.2.2 Nature and Extent of Contamination

Numerous investigations occurred at the Building 1168 Leach Well before the start of the RI.

In 1990, a groundwater survey conducted by the United States Army Environmental Hygiene Agency and an EPA RCRA Facility Assessment recommended further investigation at the Building 1168 Leach Well. This recommendation was based on the high potential for releases from the leach well and UST.

In 1992 and 1993, a Preliminary Source Evaluation was performed and included analytical measurements of surface and subsurface soil and groundwater samples. Petroleum hydrocarbons were detected in subsurface soil samples exceeding the State of Alaska cleanup levels for non-UST petroleum-contaminated soil. TCE and benzene exceeded the state and federal MCLs of 5 ppb. Ethylbenzene and xylenes also were detected in groundwater. The highest analyte concentrations in soil and groundwater were from samples closest to the leach well.

The OU-2 RI was conducted in 1993. The principal objectives of the RI at the Building 1168 Leach Well were to obtain information about the nature and extent of subsurface soil and groundwater contamination. The field investigation consisted of the following tasks: one surface soil sample, numerous subsurface soil samples, installation of two monitoring wells, collection of groundwater samples, aquifer testing, and a Treatability Study.

The RI results confirmed petroleum hydrocarbon and semivolatile organic compound contamination in groundwater, specifically benzene and TCE above state and federal MCLs of 5 ppb. No floating petroleum product (LNAPL) was found in the groundwater at this site. Manganese also exceeded risk-based concentrations but is attributable to background concentrations in this minerally rich area.

Contaminants detected in subsurface soils at the Building 1168 Leach Well include inorganics and petroleum hydrocarbons. Groundwater at the Building 1168 Leach Well contained petroleum hydrocarbons, aromatic and chlorinated VOCs, and inorganic elements. Tables 3-6, 3-7, and 3-8 list the chemicals detected in soil and groundwater at the Building 1168 Leach Well.

In subsurface soil, petroleum hydrocarbon-contaminated soil extends approximately 50 feet radially from the leach well. Contaminant concentrations decrease with increasing horizontal distance from the leach well. The thickness of subsurface soil contamination ranges from the bottom of the leach well to the seasonal low-water table elevation. A smear zone approximately 4 feet thick exists underneath the leach well and is a result of water table level fluctuations. An estimated 1,300 cubic yards of subsurface soil has been impacted by contaminants discharged from the leach well (see Figure 3-3). Table 3-6 lists the analytes detected in soil.

The contaminated soil around the leach well appears to be the source of petroleum hydrocarbons and VOCs detected in groundwater. Contamination from subsurface soil has created a comingled benzene and TCE plume in groundwater 20 feet to 50 feet BGS. The plume extends horizontally downgradient (northwest) approximately 400 feet from the leach

well (see Figure 3-4). Measurable free-floating product on the groundwater has not been detected at the Building 1168 Leach Well.

An SVE/AS pilot-scale treatability study was initiated in November 1994. Quarterly monitoring results indicate at least a 50% reduction of petroleum-related contaminants in groundwater in the active treatment zone over the last two years. Benzene and TCE were not detected within the active zone. However, exceedances of state and federal MCLs still exist outside the pilot-scale active treatment zone.

Table 3-1

SUMMARY OF SURFACE AND SUBSURFACE SOIL SAMPLE RESULTS
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(mg/kg)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding RBCs
Petroleum Hydrocarbons						
Diesel-range organics[b]	328/163	0.0038 - 9,600	AP-6738	100	NA	37
Gasoline-range organics[c]	322/66	0.25 - 690	AP-6773	50	NA	15
Volatile Organic Compounds						
1,2,4-Trimethylbenzene	323/9	0.004 - 2.8	AP-6773	39	NA	0
1,3,5-Trimethylbenzene	323/18	0.006 - 5.6	AP-6773	31	NA	0
Acetone	323/30	0.017 - 0.42	AP-6806	7,800	NA	0
Benzene	323/4	0.006 - 0.008	AP-6771	22	NA	0
Cumene (isopropylbenzene)	323/2	0.0092 - 0.016	AP-6806	3,100	NA	0
Ethylbenzene	323/5	0.003 - 0.023	AP-6771	7,800	NA	0
m&p-Xylene	323/7	0.005 - 0.077	AP-6771	160,000	NA	0
Methylene chloride	323/212	0.003 - 0.095	AP-6773	85	NA	5
n-Butylbenzene	323/6	0.006 - 0.63	AP-6806	NA	NA	NA
n-Propylbenzene	323/2	0.0082 - 0.023	AP-6806	NA	NA	NA
o-Xylene	323/7	0.002 - 0.035	AP-6771	160,000	NA	0
p-Isopropyltoluene	323/13	0.005 - 2.2	AP-6771	NA	NA	NA

Key at end of table.

Table 3-1

SUMMARY OF SURFACE AND SUBSURFACE SOIL SAMPLE RESULTS
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(mg/kg)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding RBCs
sec-Butylbenzene	323/2	0.011 - 0.220	AP-6806	780	NA	0
tert-Butylbenzene	323/1	0.0034	AP-6796	780	NA	0
Tetrachloroethene	323/24	0.0025 - 0.15	AP-6803	12	NA	0
Toluene	323/11	0.0024 - 0.09	AP-6771	16,000	NA	0
Semivolatile Organic Compounds						
2-Methylnaphthalene	328/8	0.057 - 13	AP-6773	NA	NA	NA
Acenaphthene	328/2	0.130 - 0.170	AP-6763	4,700	NA	0
Anthracene	328/4	0.050 - 0.350	AP-6796	23,000	NA	0
Benzo(a)anthracene	328/7	0.045 - 0.320	AP-6758	0.88	NA	0
Benzo(a)pyrene	328/7	0.049 - 0.350	AP-6758	0.088	NA	6
Benzo(b)fluoranthene	328/9	0.048 - 0.350	AP-6758	0.88	NA	0
Benzo(g,h,i)perylene	328/7	0.046 - 0.370	AP-6747	NA	NA	NA
Benzo(k)fluoranthene	328/7	0.052 - 0.330	AP-6758	8.8	NA	0
bis(2-ethylhexyl)-phthalate	328/28	0.029 - 1.600	AP-6745	46	NA	0
Butyl benzyl phthalate	328/7	0.150 - 0.710	AP-6798	16,000	NA	0
Chrysene	328/8	0.046 - 0.390	AP-6758	88	NA	0

Key at end of table.

Table 3-1

SUMMARY OF SURFACE AND SUBSURFACE SOIL SAMPLE RESULTS
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(mg/kg)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding RBCs
di-n-Butyl phthalate	327/133	0.024 - 2.600	004	NA	NA	NA
Dibenzo(a,h)anthracene	328/2	0.052 - 0.084	AP-6758	0.088	NA	0
Fluoranthene	328/11	0.058 - 0.660	AP-6758	3,100	NA	0
Fluorene	328/4	0.230 - 1.0	AP-6738	3,100	NA	0
Indeno(1,2,3-cd)pyrene	328/5	0.052 - 0.2	AP-6758	0.88	NA	0
Naphthalene	651/10	0.004-4.7	AP-6738	3,100	NA	0
Phenanthrene	328/16	0.059 -0.950	AP-6773	NA	NA	NA
Pyrene	328/9	0.091 - 0.640	AP-6758	2,300	NA	0
Other Organic Compounds						
Total organic carbon	331/331	290 - 40,300	AP-6736	NA	NA	NA
PCBs and Organochlorine Pesticides						
4,4'-Dichlorodiphenyldichloroethane (DDD)	331/31	0.0024 - 0.039	AP-6751	2.7	NA	0
4,4'-Dichlorodiphenyldichloroethene (DDE)	331/38	0.0016 - 0.059	AP-6739	1.9	NA	0
4,4'-Dichlorodiphenyltrichloroethane (DDT)	331/119	0.0013 - 1.1	AP-6747	1.9	NA	0

Key at end of table.

Table 3-1

SUMMARY OF SURFACE AND SUBSURFACE SOIL SAMPLE RESULTS
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(mg/kg)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding RBCs
Aroclor 1254	331/2	0.026 - 0.430	AP-6730	0.083	NA	2
Aldrin	331/1	0.00065	AP-6806	0.038	NA	0
Aroclor 1260	331/55	0.017 - 1.3	005	0.083	NA	25
beta-BHC	331/4	0.00057 - 0.0016	AP-6797	0.35	NA	0
Dieldrin	331/4	0.012 - 1.0	AP-6794	0.04	NA	2
Endosulfan I	331/1	0.016	AP-6796	470	NA	0
Endosulfan II	331/5	0.00078 - 0.016	AP-6758	470	NA	0
Endrin	331/3	0.0097 - 0.014	AP-6794	23	NA	0
Endrin aldehyde	331/1	0.0086	AP-6803	NA	NA	NA
Endrin ketone	331/5	0.0015 - 0.027	SP-6796	NA	NA	NA
gamma-BHC (Lindane)	331/6	0.0042 - 0.130	SP-6763	0.49	NA	0
Heptachlor epoxide	331/1	0.019	AP-6796	0.07	NA	0
Methoxychlor	331/1	0.0048	AP-6793	390	NA	0

Key at end of table.

Table 3-1

SUMMARY OF SURFACE AND SUBSURFACE SOIL SAMPLE RESULTS
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(mg/kg)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding RBCs
Metals						
Arsenic	332/318	0.79 - 72.4	AP-6744	0.37	29	318
Barium	331/331	18 - 381	AP-6750	5,500	234	0
Cadmium	331/84	0.48 - 8.1	AP-6782	39	NA	0
Chromium	331/330	2.7 - 46.1	AP-6742	78,000	46	0
Lead	336/332	1.7 - 996	AP-6735	400	NA	3
Manganese	331/330	29.1 - 2,420	AP-6780	390	318	33
Mercury	331/22	0.07 - 2.3	AP-6732	23	ND	0
Selenium	331/214	0.051 - 4.1	AP-6750	390	0.17	0
Silver	331/12	0.55 - 5.3	AP-6778	390	1.10	0
Thallium	331/6	0.13 - 9.8	AP-6776	NA	ND	NA
Dioxins/Furans (pg/g)						
2,3,7,8-TCDD TEQ	267/244	0.0008-97.356	AP-6734	4.1	NA	9

Note: The RBC used for m&p-xylene is the RBC for xylenes mixed. No RBC for p-xylene in soil exists. The RBC used for chromium is the one for trivalent chromium. The RBC used for arsenic is the one for the carcinogenic form of arsenic.

Key at end of table.

Table 3-1 (Cont.)

[a] Risk-based screening concentration values are based on a 1 x 10^{-6} residential direct contact risk or an HQ=1 (EPA, Region III, July 11, 1994, Risk Based Concentration Tables).
[b] ADEC soil cleanup matrix score Level A for DRO is 100 mg/kg.
[c] ADEC soil cleanup matrix score Level A for GRO is 50 mg/kg.

Key:

ADEC = Alaska Department of Environmental Conservation.
BHC = Benzenehexachloride.
DRMO = Defense Reutilization and Marketing Office.
DRO = Diesel-range organics.
GRO = Gasoline-range organics.
µg/kg = Micrograms per kilogram.
mg/kg = Milligrams per kilogram.
NA = Not applicable.
ND = Not detected.
PCBs = Polychlorinated biphenyls.
pg/g = Picograms per gram.
RBCs = Risk-based concentrations.
TCDD = Tetrachlorodibenzo-p-dioxin.
TEQ = Toxicity equivalency.

Key at end of table.

Table 3-2

SUMMARY OF SEDIMENT SAMPLE RESULTS
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(mg/kg)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding RBCs
Petroleum Hydrocarbons						
Diesel-range organics[b]	9/9	63 - 1,000	007	100	NA	5
Volatile Organic Compounds						
Chloroform	9/1	0.008	008	100	NA	0
Other Organic Compounds (%)						
Total organic carbon	7/7	1 - 9.35	007	NA	NA	NA
PCBs and Organochlorine Pesticides						
Aroclor 1260	9/3	7 - 60	007	0.083	NA	3
Metals						
Arsenic	9/9	8 - 38	001	0.37	NA	9
Barium	9/9	139 - 387	01	5,500	NA	0
Cadmium	9/4	2 - 6	007	39	NA	0
Chromium	9/9	18 - 49	007	78,000	NA	0
Lead	9/9	10 - 1,390	007	400	NA	2
Manganese	9/9	251 - 5,140	002	390	NA	7

Key at end of table.

Table 3-2

SUMMARY OF SEDIMENT SAMPLE RESULTS
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(mg/kg)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding RBCs
Dioxins/Furans (pg/g)						
2,3,7,8-TCDD TEQ	9/9	0.0043 - 71.98	007	4.10	NA	3

Note: The RBC used for chromium is the one for trivalent chromium. The RBC used for arsenic is for the carcinogenic form of arsenic.

a Risk-based screening concentration risk values are based on a 1×10^{-6} residential direct contact or an HQ = 1 (EPA, Region III, July 11, 1994, Risk-Based Concentration Tables).

b ADEC soil cleanup matrix score for Level A cleanup of DRO is 100 mg/kg.

Key:

ADEC = Alaska Department of Environmental Conservation.
DRO = Diesel-range organics.
DRMO = Defense Reutilization and Marketing Office.
µg/kg = Micrograms per kilogram.
mg/kg = Milligrams per kilogram.
NA = Not applicable.
PCBs = Polychlorinated biphenyls.
pg/g = Picograms per gram.
RBCs = Risk-based concentrations.
TCDD = Tetrachlorodibenzo-p-dioxin.
TEQ = Toxicity equivalency.

Table 3-3

SUMMARY OF GROUNDWATER MONITORING WELL SAMPLE RESULTS
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(µg/L)

Analyte	Number of Samples Analyzed/ Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria (18 AAC 70/MCL 18 AAC 80)	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding MCL
Petroleum Hydrocarbons							
Diesel-range organics	23/16	130 - 23,000	AP-5825	NA/NA	NA	NA	NA
Gasoline-range organics	31/8	50 - 940	AP-5825	NA/NA	NA	NA	NA
Volatile Organic Compounds							
1,2,4-Trimethylbenzene	31/5	2.9 - 460	AP-5825	100/70	3	NA	1
1,3,5-Trimethylbenzene	31/5	3.7 - 130	AP-5825	100/NA	2.4	NA	NA
Chloroform	31/1	1.9	AP-6802	1,240/100	0.15	NA	0
cis-1,2-Dichloroethene	31/1	7.3	AP-5764	11,600/70	61	NA	0
Cumene	31/5	1.6 - 14	AP-5825	NA/NA	1,500	NA	NA
Ethylbenzene	31/3	2.6 - 3.7	AP-5825	0.2/700	1,300	NA	0
m&p-Xylene	31/3	3.2 - 92	AP-5825	0.2/10,000	520	NA	0
Methyl ethyl ketone	31/2	6.4 - 12	AP-5825	NA/NA	22,000	NA	NA
Methylene chloride	31/12	1 - 1.9	AP-6799	NA/5	4.1	NA	0
n-Butylbenzene	31/1	3.3	AP-6806	NA/NA	NA	NA	NA
n-Propylbenzene	3/31	1.7 - 16	AP-5825	NA/NA	NA	NA	NA

Key at end of table.

Table 3-3

SUMMARY OF GROUNDWATER MONITORING WELL SAMPLE RESULTS
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(µg/L)

Analyte	Number of Samples Analyzed/ Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria (18 AAC 70/MCL 18 AAC 80)	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding MCL
Naphthalene	54/6	14 - 530	AP-5825	0.1/NA	1,500	NA	NA
o-Xylene	31/1	170	AP-5825	0.2/10,000	1,400	NA	0
p-Isopropyltoluene	31/2	3.5 - 19	AP-5825	NA/NA	NA	NA	NA
sec-Butylbenzene	31/7	1.6 - 11	AP-5825	NA/NA	61	NA	NA
Tetrachloroethene (PCE)	31/6	1.3 - 190	AP-6803	840/5	1.1	NA	3
trans-1,2-Dichloroethene	3/31	1.2 - 1.7	AP-6804	11,600/100	120	NA	0
Trichloroethene (TCE)	5/31	4.8 - 17	AP-6804	5/5	1.6	NA	3
Trichlorofluoromethane	31/1	6.3	AP-5764	NA/NA	1,300	NA	NA
Semivolatile Organic Compounds							
2-Methylnaphthalene	23/5	11 - 200	AP-5825	0.1/NA	NA	NA	NA
Benzoic acid	23/1	19	AP-6803	NA/NA	150,000	NA	NA
Fluorene	23/1	2	AP-6803	0.1/NA	1,500	NA	NA
Naphthalene	54/6	14 - 530	AP-5825	0.1/NA	1,500	NA	NA
Organophosphorus Pesticides							
Disulfoton	23/3	0.14 - 1.3	AP-5826	NA/NA	1.5	NA	NA

Key at end of table.

Table 3-3

SUMMARY OF GROUNDWATER MONITORING WELL SAMPLE RESULTS
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(µg/L)

Analyte	Number of Samples Analyzed/ Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria (18 AAC 70/MCL 18 AAC 80)	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding MCL
Metals							
Arsenic (dissolved)	23/13	6 - 24	AP-5825	48/50	0.038	56	0
Arsenic (total)	23/13	6 - 23	AP-5825	48/50	0.038	230	0
Barium (dissolved)	23/20	100 - 310	AP-5825	1,000/2,000	2,600	520	0
Barium (total)	23/20	100 - 320	AP-5825	1,000/2,000	2,600	2,000	0
Lead (dissolved)	23/1	6	AP-6802	NA/15	NA	27	0
Manganese (dissolved)	23/20	250 - 13,000	AP-5825	50[b]	180	1,900	20
Manganese (total)	23/20	270 - 13,000	AP-5825	50[b]	180	1,900	20
Dioxins/Furans (pg/L)							
2,3,7,8-TCDD TEQ	20/19	0.33 - 8.4183	AP-5765	10/30	0.43	NA	0

Note: The RBC used for m&p-xylene is the one for p-xylene. This RBC is the more conservative of the two. The RBC used for arsenic is for the carcinogenic form of arsenic.

[a] Risk-based screening concentration values are based on a 1×10^{-6} residential direct contact risk or HQ = 1 (EPA, Region III, July 11, 1994, Risk Based Concentration Tables).
[b] Secondary MCL.

Table 3-3 (Cont.)

Key at end of table.

Key:

AAC = Alaska Administrative Code.
DRMO = Defense Reutilization and Marketing Office.
MCL = Maximum contaminant level.
µg/L = Micrograms per liter.
NA = Not applicable.
pg/L = Picograms per liter.
TCDD = Tetrachlorodibenzo-p-dioxin.
TEQ = Toxicity equivalency.

Table 3-4

SUMMARY OF GROUNDWATER PROBE SAMPLE RESULTS
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(µg/L)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding MCLs
Petroleum Hydrocarbons							
Diesel-range organics	94/65	120 - 41,000	P34	NA/NA	NA	NA	NA
Gasoline-range organics	89/19	70 - 28,000	P34	NA/NA	NA	NA	NA
Volatile Organic Compounds							
1,2,4-Trimethylbenzene	93/11	1.3 - 340	P35	100/NA	3	NA	NA
1,2-Dichlorobenzene	161/2	19 - 38	P15	763/600	370	NA	0
1,2-Dichloroethane	93/1	1.5	P13	5/5	0.12	NA	0
1,3,5-Trimethylbenzene	93/10	1.3 - 130	P35	100/NA	2.4	NA	NA
1,3-Dichlorobenzene	161/1	1.5	P60	763/NA	540	NA	NA
1,4-Dichlorobenzene	161/2	6 - 12	P15	763/75	0.44	NA	0
Acetone	93/7	3.1 - 79	P35	NA/NA	3,700	NA	NA
Benzene	93/6	1.4 - 7.5	P05	0.2/5.0	0.36	NA	3
Chlorobenzene	93/1	2.6	P15	NA/100	39	NA	0
Chloroform	93/27	1.1 - 8	MW2	1,240/100	0.15	NA	0
cis-1,2-Dichloroethene	93/3	1.2 - 2.3	P59	116,000/70	61	NA	0
Cumene	93/10	1.4 - 14	P34	NA/NA	1,500	NA	NA

Key at end of table.

Table 3-4

SUMMARY OF GROUNDWATER PROBE SAMPLE RESULTS
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(µg/L)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding MCLs
Dichlorodifluoromethane	93/2	1.7 - 18	P07	11,000/NA	390	NA	NA
Ethylbenzene	93/7	1.3 - 6	P27	0.2/700	1,300	NA	0
m&p-Xylene	93/8	1.6 - 87	P35	0.2/10,000	520	NA	0
Methyl ethyl ketone (MEK)	93/21	2 - 110	Trip Blank	NA/NA	22,000	NA	NA
Methylene chloride	93/26	1 - 8.8	P35	NA/5	4.1	NA	2
n-Butylbenzene	93/1	30	P34	NA/NA	NA	NA	NA
n-Propylbenzene	93/8	1.6 - 32	P34	NA/NA	NA	NA	NA
x-Xylene	93/7	1.2 - 150	P35	0.2/10,000	NA	NA	0
p-Isopropyltoluene	93/10	1.5 - 200	P34	NA/NA	NA	NA	NA
sec-Butylbenzene	93/7	1.2 - 25	P34	NA/NA	61	NA	NA
Styrene	93/2	1.7 - 69	P57	NA/100	1,600	NA	0
Tetrachloroethene (PCE)	93/20	1.1 - 65	P35	840/5	1.1	NA	3
Toluene	93/5	1.5 - 3.7	P61	0.2/1,000	750	NA	0
trans-1,2-Dichloroethene	93/6	1.3 - 4.4	P43	11,600/100	120	NA	0
Trichloroethene (TCE)	93/19	1.4 - 9.1	P51	5/5	1.6	NA	12
Trichlorofluoromethane	93/2	1.6 - 4.1	P12	NA/NA	1,300	NA	0

Key at end of table.

Table 3-4

SUMMARY OF GROUNDWATER PROBE SAMPLE RESULTS
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(µg/L)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding MCLs
Semivolatile Organic Compounds							
2-Methylnaphthalene	68/9	1 - 240	P35	0.1/NA	NA	NA	NA
Dibenzofuran	68/1	2	P34	NA/NA	150	NA	NA
Diethylphthalate	68/1	10	P34	NA/NA	29,000	NA	NA
Fluorene	68/2	4 - 6	P34	0.1/NA	1,500	NA	NA
Naphthalene	161/20	1.6 - 410	P35	0.1/620	1,500	NA	0
Phenanthrene	68/1	4	P34	0.1/NA	NA	NA	NA
Organophosphorus Pesticides							
Diazinon	68/1	0.27	P37	NA/NA	33	NA	NA
Disulfoton	68/2	0.11 - 0.53	P46	NA/NA	1.5	NA	NA
Naled	68/2	0.18 - 0.87	P60	NA/NA	73	NA	NA
Ronnel	68/1	1,100	P27	NA/NA	1,800	NA	NA
Metals							
Arsenic (dissolved)	67/34	5 - 39	P39	48/50	0.038	56	0
Arsenic (total)	68/35	6 - 43	P39	48/50	0.038	230	0
Barium (dissolved)	67/64	30 - 420	P07	1,000/2,000	2,600	520	0

Key at end of table.

Table 3-4

SUMMARY OF GROUNDWATER PROBE SAMPLE RESULTS
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(µg/L)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding MCLs
Barium (total)	68/65	30 - 1,200	P04	1,000/2,000	2,600	2,000	0
Chromium (total)	64/8	20 - 510	P57	11/100	37,000	390	2
Lead (dissolved)	67/3	3 - 5	P23	NA/15	0.0037	27	0
Lead (total)	68/10	2 - 14	P21	NA/15	0.0037	160	0
Manganese (dissolved)	67/63	20 - 6,100	P35	NA/50[b]	180	1,900	57
Manganese (total)	68/65	20 - 6,400	P35	NA/50[b]	180	1,900	57
Mercury (dissolved)	67/1	0.8	P Slough 1	0.012/2	11	NA	0
Dioxins (pg/L)							
2,3,7,8-TCDD TEQ	68/50	0.02 - 8.66	P25	10/30	0.43	NA	0

Note: The RBC used m&p-xylene as the one for p-xylene. This RBC is the more conservative of the two RBCs. The RBC used for arsenic is for the carcinogenic form of arsenic.

a Risk-based screening concentration values are based on a 1×10^{-6} residential direct contact risk or HQ = 1 (EPA, Region III, July 11, 1994, Risk Based Concentration Tables).
b Secondary MCL.

Key at end of table.

Table 3-4 (Cont.)

Key:

AAC = Alaska Administrative Code.
DRMO = Defense Reutilization and Marketing Office.
MCL = Maximum contaminant level.
µg/L = Micrograms per liter.
NA = Not applicable.
pg/L = Picograms per liter.
TCDD = Tetrachlorodibenzo-p-dioxin.
TEQ = Toxicity equivalency.

Table 3-5

SUMMARY OF SURFACE WATER SAMPLE RESULTS
COLLECTED FROM CHANNEL B
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(µg/L)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding MCLs
Petroleum Hydrocarbons							
Diesel-range organics	4/1	62	003	NA/NA	NA	NA	NA
Volatile Organic Compounds							
Chloroform	4/3	0.5 - 3.2	002	1,240/100	0.15	NA	0
Methylene chloride	4/3	1 - 1	002	NA/NA	4.1	NA	NA
Metals							
Barium (dissolved)	4/4	71 - 74	001	1,000/2,000	2,600	520	0
Barium (total)	4/4	70 - 74	003	1,000/2,000	2,600	2,000	0
Manganese (dissolved)	4/4	479 - 536	001	NA/50[b]	180	1,900	4
Manganese (total)	4/4	478 - 532	001	NA/50[b]	180	1,900	4

[a] Risk-based screening concentration values are based on a 1×10^{-6} residential risk or an HQ=1 (EPA, Region III, July 11, 1994, Risk Based Concentration Tables).
[b] Secondary MCL.

Key at end of table.

Table 3-5 (Cont.)

Key:

AAC = Alaska Administrative Code.
DRMO = Defense Reutilization and Marketing Office.
MCL = Maximum contaminant level.
µg/L = Micrograms per liter.
NA = Not applicable.

Table 3-6

SUMMARY OF SOIL SAMPLE RESULTS
BUILDING 1168 LEACH WELL SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(mg/kg)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding RBCs
PCBs and Organochlorine Pesticides						
4,4'-Dichlorodiphenyltrichloroethane	5/1	0.0048	AP-6808	1.9	NA	1
Metals						
Arsenic	5/5	1.3 - 5.1	AP-6808	0.37	17	5
Barium	5/5	29 - 120	AP-6808	5,500	275	0
Cadmium	5/5	0.73 - 2.2	AP-6808	39	1.7	0
Chromium	5/5	6.8 - 22	AP-6808	78,000	35	0
Lead	5/5	2.4 - 7.9	AP-6808	400	25	0
Manganese	5/5	93 - 380	AP-6808	390	NA	0
Selenium	5/1	0.22	AP-6808	390	NA	0
Silver	5/4	0.98 - 3.7	AP-6808	390	NA	0
Petroleum Hydrocarbons						
DRO	7/7	260 - 7,700	SB-2	100[b]	NA	7
GRO	7/7	26 - 4,600	SB-1	50[c]	NA	6
Volatile Organic Compounds						
Benzene	7/0	NA	NA	22	NA	NA
m&p-Xylenes	7/6	4.4 - 62	SB-3	160,000	NA	0

Key at end of table.

Table 3-6

SUMMARY OF SOIL SAMPLE RESULTS
BUILDING 1168 LEACH WELL SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(mg/kg)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding RBCs
o-Xylenes	7/6	2.9 - 31	SB-3	160,000	NA	0
Toluene	7/4	0.34 - 10	SB-3	16,000	NA	0
BTEX	7/6	7.3 - 103	SB-3	10[d]	NA	5
Trichloroethene	7/0	NA	NA	58	NA	0

Note: The RBC used for m&p-xylenes is the RBC for xylenes mixed. No RBC existes for p-xylenes in soil. The RBC used for arsenic is the one for the carcinogenic form of arsenic. The RBC used for chromium is the one for trivalent chromium.

a Risk-based screening concentration values are based on a 1×10^{-6} residential direct contact risk or an HQ=1 (EPA Region III, July 11, 1994, Risk Based Concentration Tables).

b ADEC soil cleanup matrix score for Level A DRO is 100 mg/kg.

c ADEC soil cleanup matrix score for Level A GRO is 50 mg/kg.

d ADEC soil cleanup matrix score for Level A BTEX is 10 mg/kg.

Key:

BTEX = Benzene, toluene, ethylbenzene, and total xylenes.
DRO = Diesel-range organics.
GRO = Gasoline-range organics.
mg/kg = Milligrams per kilogram.
NA = Not applicable.
PCBs = Polychlorinated biphenyls.
RBCs = Risk-based concentrations.

Table 3-7

SUMMARY OF GROUNDWATER SAMPLE RESULTS
BUILDING 1168 LEACH WELL SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(μg/L)

Analyte and Concentration Units	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding MCLs
Petroleum Hydrocarbons							
Diesel-range organics	15/9	77 - 34,000	AP-5751	NA/NA	NA	NA	NA
Gasoline-range organics	20/7	11 - 18,000	AP-5747	NA/NA	NA	NA	NA
Volatile Organic Compounds							
1,2,4-Trimethylbenzene	20/4	49 - 350	AP-5751	100/NA	3	NA	NA
1,3,5-Trimethylbenzene	20/4	18 - 150	AP-5751	100/NA	2.4	NA	NA
Acetone	20/1	41	AP-5751	NA/NA	3,700	NA	NA
Benzene	20/1	5.1	AP-5752	0.2/5	0.36	NA	1
Cumene	20/4	18 - 59	AP-5751	NA/NA	1,500	NA	NA
Ethylbenzene	20/4	26 - 310	AP-5751	0.2/700	1,300	NA	0
m&p-Xylene	20/4	44 - 620	AP-5751	0.2/10,000	520	NA	0
n-Butylbenzene	20/3	13 - 16	AP-5747	NA/NA	NA	NA	NA
n-Propylbenzene	20/4	21 - 71	AP-5751	NA/NA	NA	NA	NA
Naphthalene	35/8	5 - 130	AP-5751	0.1/NA	1,500	NA	NA
o-Xylene	20/4	3 - 1,000	AP-5751	0.2/10,000	1,400	NA	0

Key at end of table.

Table 3-7

SUMMARY OF GROUNDWATER SAMPLE RESULTS
BUILDING 1168 LEACH WELL SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(µg/L)

Analyte and Concentration Units	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding MCLs
p-Isopropyltoluene	20/4	10 - 30	AP-5751	NA/NA	NA	NA	NA
sec-Butylbenzene	20/4	4.4 - 11	AP-5751	NA/NA	61	NA	NA
Toluene	20/1	770	AP-5751	0.2/1,000	750	NA	0
Trichloroethene	20/1	23	AP-5751	5/5	1.6	NA	1
Trichlorofluoromethane	20/3	5.1 - 26	AP-5781	NA/NA	1,300	NA	NA
Semivolatile Organic Compounds							
2-Methylnaphthalene	15/4	5 - 59	AP-5751	0.1/NA	NA	NA	NA
Naphthalene	35/8	5 - 130	AP-5751	0.1/NA	1,500	NA	NA
Metals							
Arsenic (dissolved)	15/7	1/2 - 27	AP-5751	48/50	0.038	20	0
Arsenic (total)	16/6	1.8 - 25	AP-5751	48/50	0.038	72	0
Barium (dissolved)	15/14	62 - 350	AP-5751	1,000/2,000	2,600	988	0
Barium (total)	16/14	48 - 330	AP-5751	1,000/2,000	2,600	341	0
Cadmium (dissolved)	15/1	4.9	AP-6333	9.3/5	18	4.8	0
Chromium (total)	16/2	8 - 48	AP-6332	11/100	37,000	NA	0

Key at end of table.

Table 3-7

SUMMARY OF GROUNDWATER SAMPLE RESULTS
BUILDING 1168 LEACH WELL SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(μg/L)

Analyte and Concentration Units	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding MCLs
Lead (dissolved)	15/2	1.6 - 5.4	AP-5751	NA/15	0.0037	9.9	0
Lead (total)	16/14	1.1 - 21	AP-5751	NA/15	0.0037	66	1
Manganese (dissolved)	15/13	82 - 4,400	AP-5751	NA/50[b]	180	NA	11
Manganese (total)	16/14	11 - 4,400	AP-5751	NA/50[b]	180	NA	11
Selenium (dissolved)	15/2	2.4 - 3.1	AP-5751	10/50	180	NA	0
Selenium (total)	16/3	1.7 - 2.5	AP-5751	10/50	180	NA	0
Silver (total)	16/1	22	AP-5781	NA/100[b]	180	NA	0

Note: The RBC used for m&p-xylene is the one for p-xylene. This RBC is the more conservative of the two. The RBC used for arsenic is the one for the carcinogenic form of arsenic. The RBC used for chromium is the one for trivalent chromium.

[a] Risk-based screening concentration values based on a 1×10^{-6} residential risk or an HQ=1 (EPA, Region III, July 11, 1994, Risk Based Concentration Tables).
[b] Secondary MCL.

Key:

AAC = Alaska Administrative Code.
MCLs = Maximum contaminant levels.
μg/L = Micrograms per liter.
NA = Not applicable.

Table 3-8

SUMMARY OF MICROWELL SAMPLE RESULTS
BUILDING 1168 LEACH WELL SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(µg/L)

Analytes	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding MCLs
Metals							
Aluminum	27/27	135 - 39,300	PS10	NA/200	37,000	NA	24
Arsenic	27/15	6 - 44	PS12	48/50	0.038	76	0
Barium	27/27	104 - 1,030	PS10	1,000/2,000	2,600	988	0
Chromium	27/16	6 - 90	PS26	11/100	37,000	125	0
Copper	27/17	12 - 222	PS26	12/1,000	1,400	NA	0
Iron	27/27	1,340 - 188,000	PS26	1,000/300	NA	NA	27
Lead	27/17	2 - 49	PS10	3.2/15	0.0037	66	10
Manganese	27/27	25 - 2,930	PS21	NA/50[b]	180	NA	26
Vanadium	27/14	10 - 116	PS10	NA/NA	260	NA	NA
Zinc	27/19	16 - 242	PS10	47/5,000	11,000	NA	0
Petroleum Hydrocarbons							
GRO	27/10	57 - 63,100	PS01	NA/NA	NA	NA	NA
DRO	27/27	55 - 28,400	PS01	NA/NA	NA	NA	NA

Key at end of table.

Table 3-8

SUMMARY OF MICROWELL SAMPLE RESULTS
BUILDING 1168 LEACH WELL SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(µg/L)

Analytes	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding MCLs
Volatile Organic Compounds							
1,2,4-Trimethylbenzene	27/6	2 - 800	PS01	100/NA	3	NA	NA
1,3,5-Trimethylbenzene	27/5	3 - 370	PS01	100/NA	2.4	NA	NA
1,3-Dichlorobenzene	27/1	3	PS21	763/NA	540	NA	NA
2-Butanone (MEK)	27/2	2 - 3	PS10	NA/NA	22,000	NA	NA
4-Chlorotoluene	27/1	5	PS21	NA/NA	NA	NA	NA
Acetone	27/9	2 - 9	PS09	NA/NA	3,700	NA	NA
Benzene	27/12	0.6 - 250	PS01	0.2/5.0	0.36	NA	8
Bromobenzene	27/1	9	PS21	NA/NA	NA	NA	NA
Carbon disulfide	27/2	0.5 - 1	PS05	NA/NA	21	NA	NA
Chloroform	27/1	2.4	PS11	1,240/100	0.15	NA	0
Dichlorodifluoromethane	27/7	0.7 - 1	PS15	NA/NA	390	NA	NA
Ethylbenzene	27/8	3.6 - 650	PS01	0.2/700	1,300	NA	0
Cumene (Isopropylbenzene)	27/5	2 - 10	PS01	NA/NA	1,500	NA	NA

Key at end of table.

Table 3-8

SUMMARY OF MICROWELL SAMPLE RESULTS
BUILDING 1168 LEACH WELL SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA
(µg/L)

Analytes	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration[a]	Background Concentration	Number of Samples Exceeding MCLs
Naphthalene	27/3	6 - 250	PS01	0.1/NA	1,500	NA	NA
Toluene	27/8	0.6 - 2,700	PS01	0.2/1,000	750	NA	2
Total xylenes	27/10	1.4 - 4,300	PS01	NA/10,000	12,000	NA	0
Trichloroethene	27/6	1.0 - 47	PS23	5/5	1.6	NA	4
Trichlorofluoromethane	27/7	0.5 - 17	PS11	NA/NA	1,300	NA	NA
cis-1,2-Dichloroethene	27/4	0.7 - 9.5	PS21	11,600/70	61	NA	0
n-Propylbenzene	27/2	4 - 6	PS21	NA/NA	NA	NA	NA
Semivolatile Organic Compounds							
2-Methylnaphthalene	27/3	19 - 29	PS23	0.1/NA	NA	NA	NA
3- and 4-Methylphenol	27/3	18 - 64	PS01	NA/NA	180	NA	NA
Naphthalene	27/4	10 - 87	PS23	0.1/NA	1,500	NA	NA

Key at end of table.

Table 3-8 (Cont.)

Note: The RBC used for arsenic is for the carcinogenic form of arsenic. The RBC used for chromium is the one for trivalent chromium. The RBC used for xylenes is the one for xylenes mixed. The RBC used for 3- and 4-methylphenol is the one for 4-methylphenol, the more conservative of the two.

[a] Risk-based screening concentration values based on a 1×10^{-6} residential risk or HQ=1 (EPA, Region III, July 11, 1994, Risk-Based Concentration Tables).
[b] Secondary MCL.

Key:

AAC = Alaska Administrative Code.
DRO = Diesel-range organics.
GRO = Gasoline-range organics.
MCLs = Maximum contaminant levels.
MEK = Methyl ethyl ketone.
µg/L = Micrograms per liter.
NA = Not applicable.
VOCs = Volatile organic compounds.

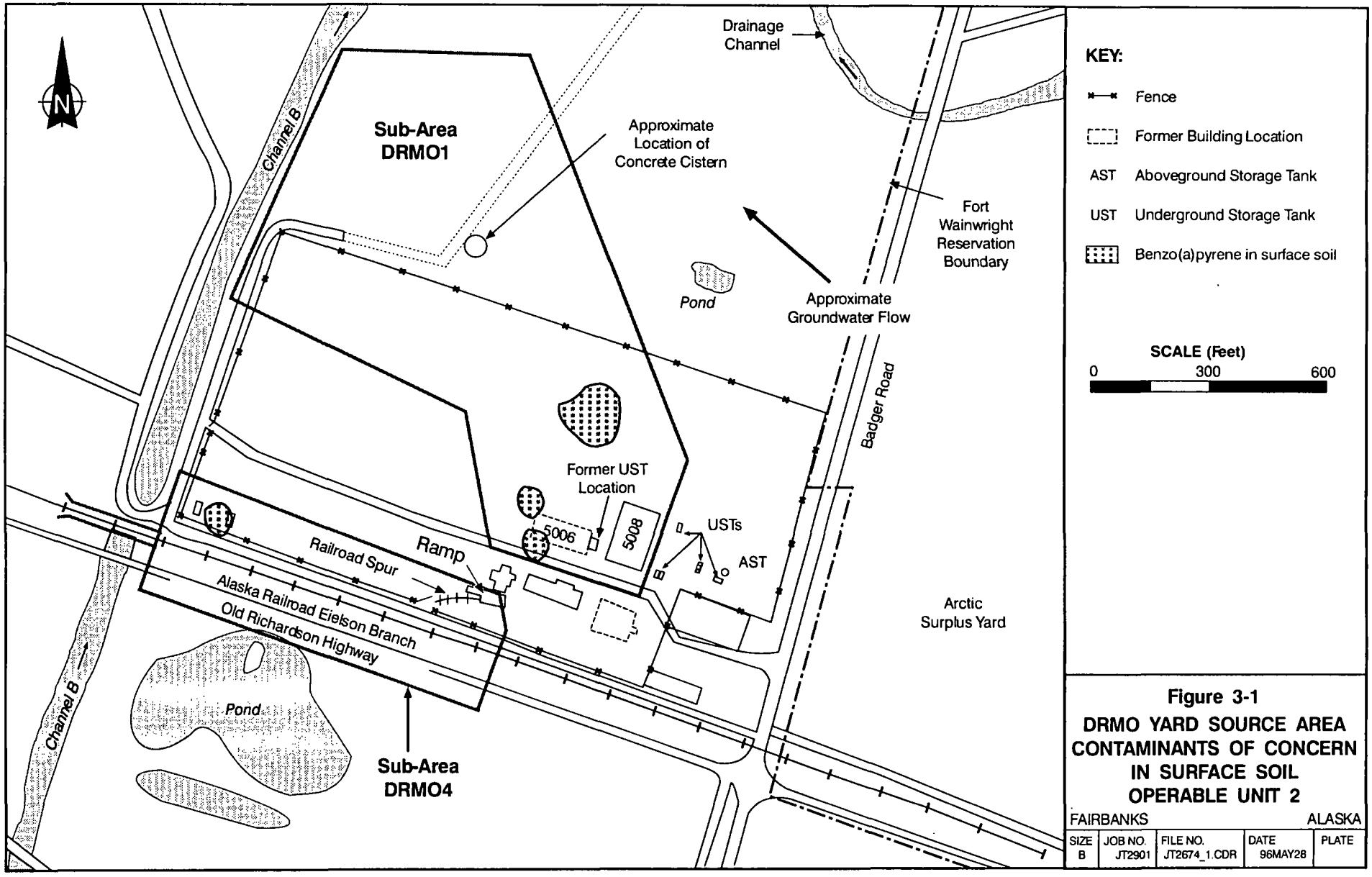
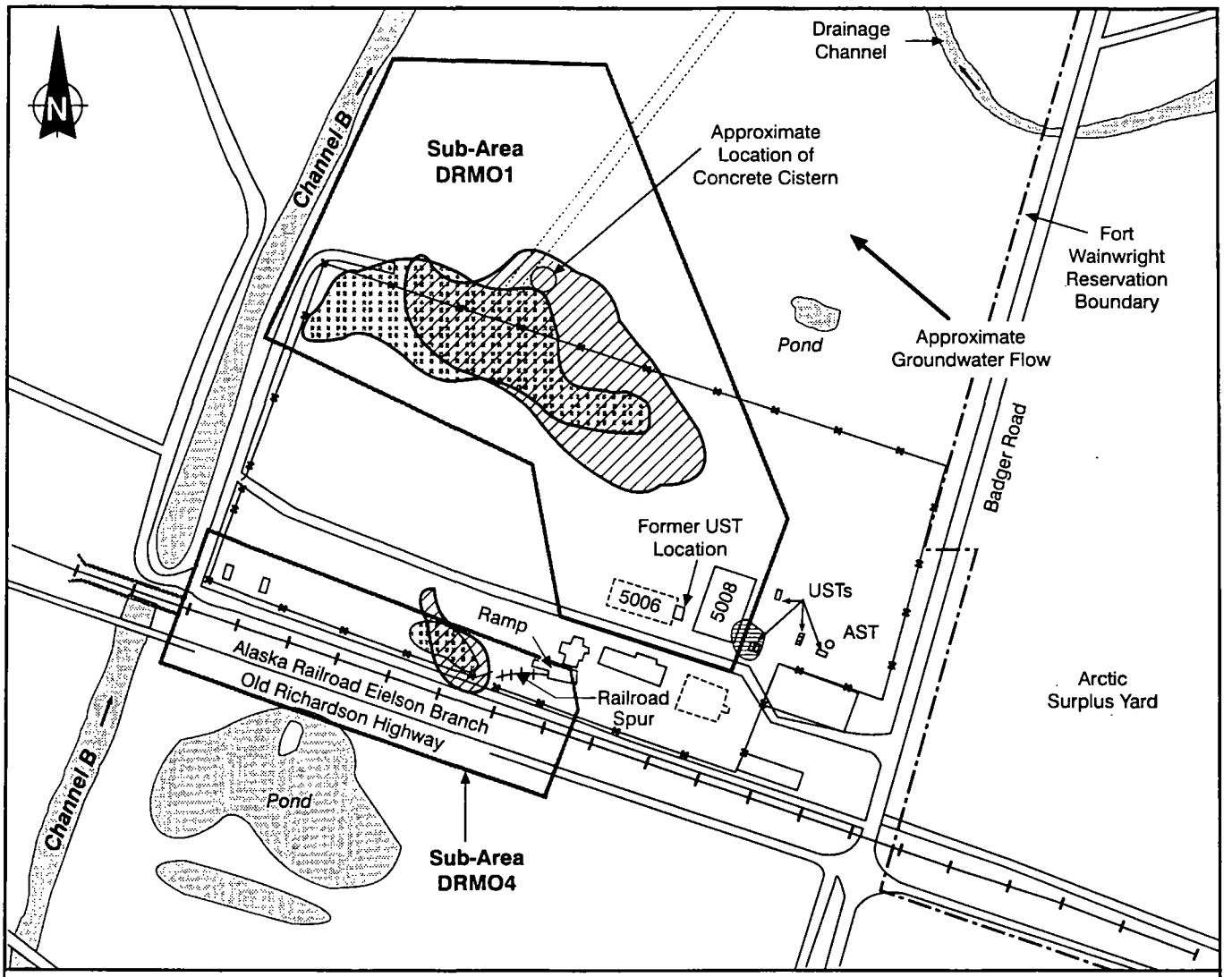


Figure 3-1
DRMO YARD SOURCE AREA CONTAMINANTS OF CONCERN IN SURFACE SOIL OPERABLE UNIT 2

FAIRBANKS ALASKA

SIZE	JOB NO.	FILE NO.	DATE	PLATE
B	JT2901	JT2674_1.CDR	96MAY28	



KEY:

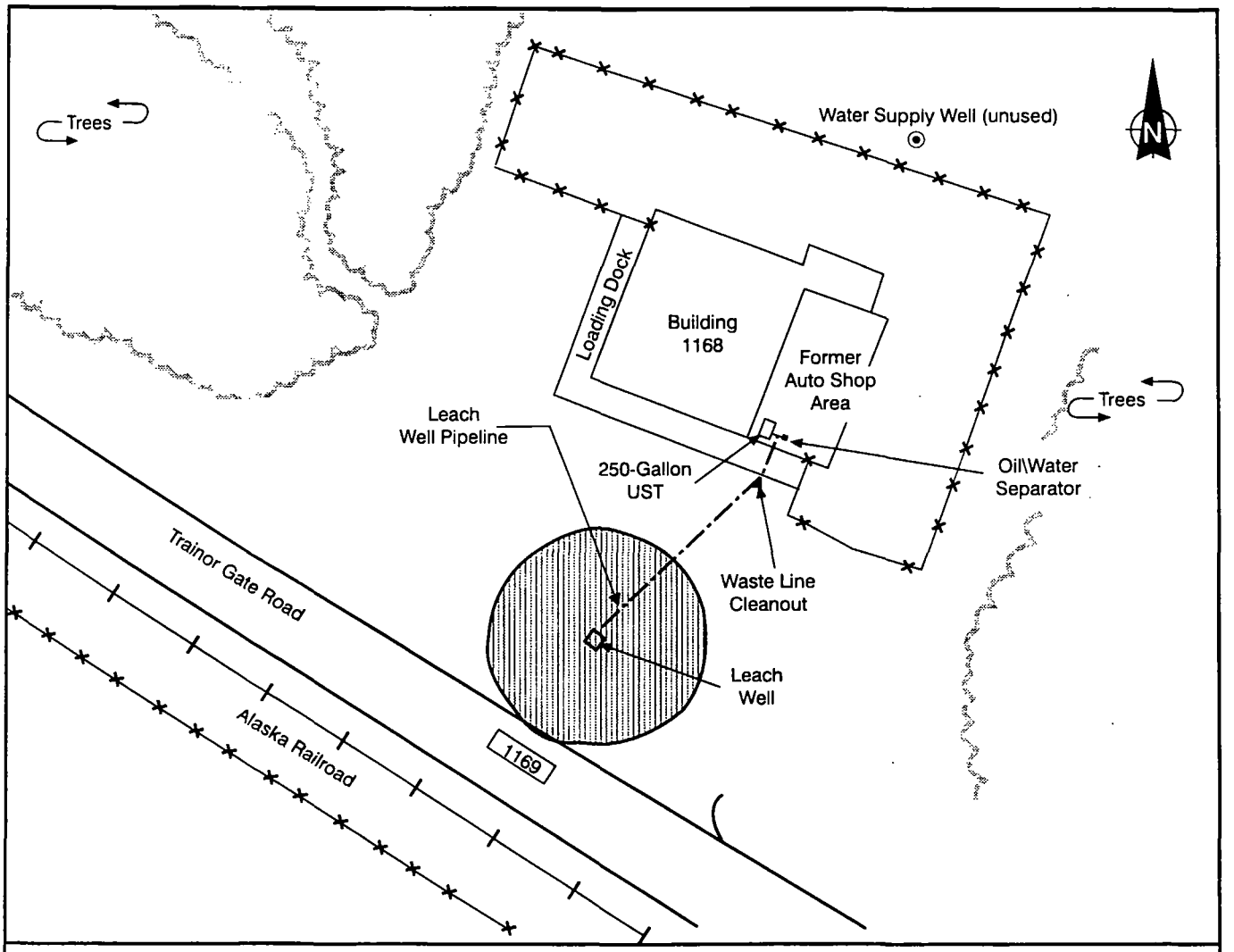
- Fence
- Former Building Location
- AST Aboveground Storage Tank
- UST Underground Storage Tank
- Benzene in groundwater
- Tetrachloroethene in groundwater
- Trichloroethene in groundwater

SCALE (Feet)
0 300 600

Figure 3-2
DRMO YARD SOURCE AREA
CONTAMINANTS OF CONCERN
IN GROUNDWATER
OPERABLE UNIT 2

FAIRBANKS ALASKA

SIZE	JOB NO.	FILE NO.	DATE	PLATE
B	JT2901	JT2674_2.CDR	96MAY28	



KEY:

- Fence
- Building Location
- UST Underground Storage Tank
- Below ground piping
- Diesel Range Organics, Gasoline Range Organics, Benzene, Toluene, Ethylbenzene, and Xylene in subsurface soil

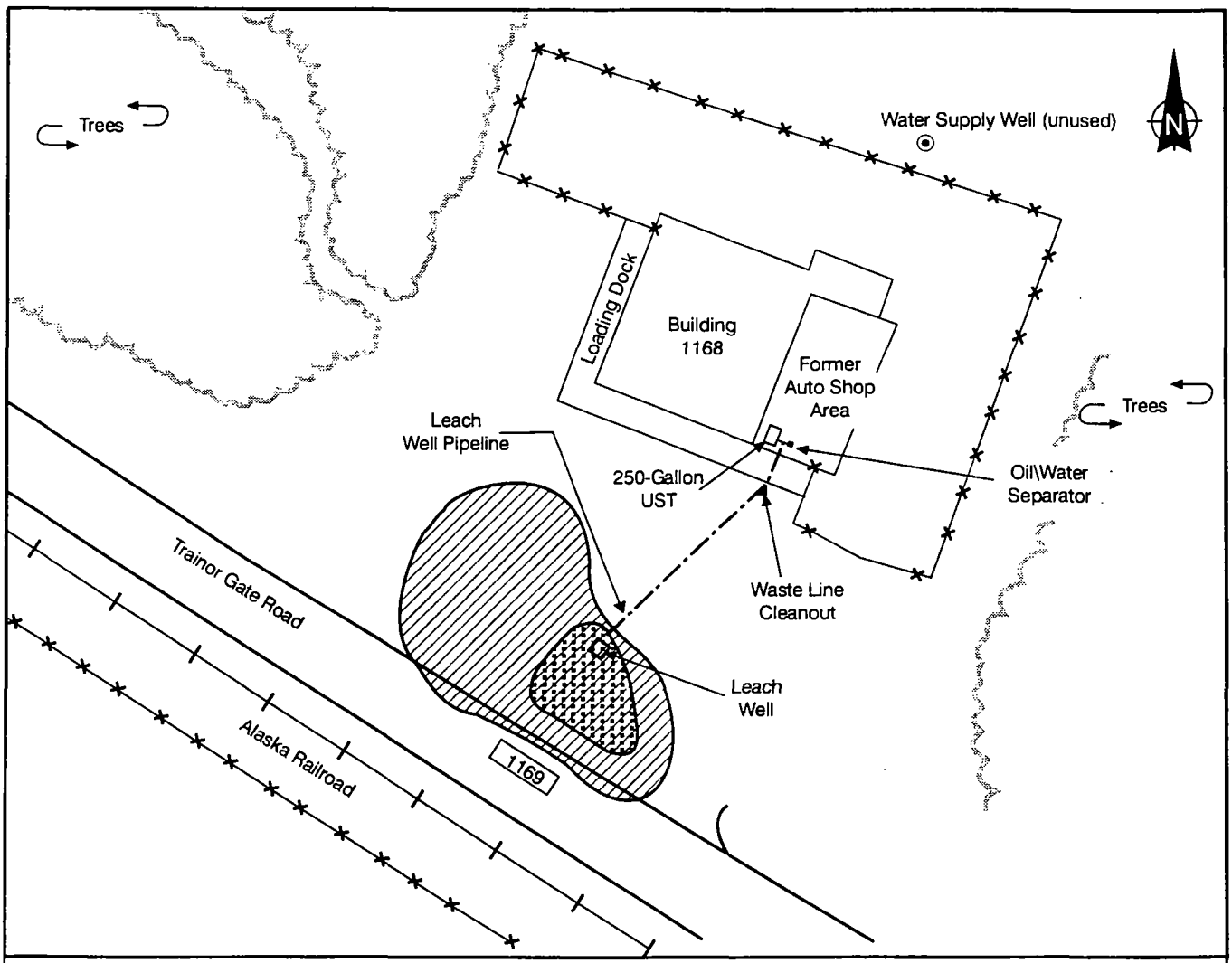
SCALE (Feet)

0 50 100

Figure 3-3
BUILDING 1168 LEACH WELL SOURCE AREA CONTAMINANTS OF CONCERN IN SUBSURFACE SOIL OPERABLE UNIT 2

FAIRBANKS ALASKA

SIZE	JOB NO.	FILE NO.	DATE	PLATE
B	JT2901	JT2674_4.CDR	96MAY28	



KEY:

- Fence
- Building Location
- UST — Underground Storage Tank
- Below ground piping
- Trichloroethene in groundwater
- Benzene in groundwater

SCALE (Feet)

0 50 100

Figure 3-4

BUILDING 1168 LEACH WELL SOURCE AREA CONTAMINANTS OF CONCERN IN GROUNDWATER OPERABLE UNIT 2

FAIRBANKS ALASKA

SIZE	JOB NO.	FILE NO.	DATE	PLATE
B	JT2901	JT2674_3.CDR	96MAY28	

4.0 SUMMARY OF SITE RISKS

The Baseline Human Health and Ecological Risk Assessment is one mechanism for determining the need for taking action at the source areas and indicates exposure pathways that need to be addressed by remedial action. Risk Assessments are performed using information regarding contaminants and assumptions regarding the extent to which people may be exposed to them. This summary of the Baseline Human Health Risk Assessment for the source areas is divided into the five following sections:

- Identification of chemicals of potential concern;
- Exposure assessment;
- Toxicity assessment;
- Risk characterization, which is an integration and summary of the information gathered and analyzed in the preceding sections; and
- Analysis of the uncertainties involved in developing a Risk Assessment.

The summary concludes with the results of the Ecological Risk Assessment conducted for the DRMO Yard and Building 1168 Leach Well.

Human Health and Ecological Risk Assessments were conducted for OU-2 to determine potential risks in the absence of remedial action. CERCLA guidance allows the Baseline Human Health Risk Assessment to reflect the expected future use of a site. Scenarios involving future residential use of the DRMO Yard and Building 1168 Leach Well were completed; however, these scenarios were determined to not be appropriate for soils because industrial use is the reasonably anticipated future use, based on the Post Master Plan and historical use of both areas.

It was determined, because of site hydrological conditions, that future residential risks identified in the Baseline Human Health Risk Assessment apply to groundwater because an exposure pathway for domestic water users exists. The NCP requires that groundwater be returned to its beneficial uses whenever practicable. At these source areas, the beneficial use is domestic water supply.

4.1 IDENTIFICATION OF CONTAMINANTS OF CONCERN

Selection of contaminants of concern, which are chemicals that potentially contribute to human health risks at the source areas, was a three-step process. First, the maximum concentrations of contaminants detected in on-site soil and water during the RI field investigation were compared to health-based screening levels for soil and drinking water developed by EPA, Region 3, (April 20, 1994) and Region 10, *Supplemental Risk Assessment Guidance*. These standards reflect residential exposure assumptions of 1×10^{-6} and 1×10^{-7} risks associated with groundwater and soil, respectively, or a hazard quotient of 0.1 for all media. Secondly, inorganic chemicals were compared to naturally occurring background levels. If concentrations were found below established background levels, they were

eliminated from further consideration. Thirdly, chemicals detected at a frequency of less than 1% were eliminated from consideration unless their concentration was significantly higher than EPA's health-based screening levels. While soil contamination did not pose a direct threat to human health, it does act as an ongoing source of contamination to groundwater.

Table 4-1 presents the contaminants of concern identified in each environmental medium evaluated for each source area.

4.2 EXPOSURE ASSESSMENT

The exposure assessment estimates the type and magnitude of exposures to the contaminants of concern at the source areas. The exposure assessment considers the current and potential future uses of the source area, characterizes the potentially exposed populations, identifies the important exposure pathways, and quantifies the intake of each contaminant of concern from each medium for each population at risk. The Human Health Risk Assessment for OU-2 was completed for the DRMO Yard and Building 1168 Leach Well.

4.2.1 Identification of Site Uses, Exposed Populations, and Exposure Pathways

4.2.1.1 Source Area Land Use Scenarios

The exposure assessment for the DRMO Yard and Building 1168 Leach Well source areas considers land use scenarios to evaluate exposed populations. The Baseline Human Health Risk Assessment evaluated future residential land use of the site, which assumes that individuals would spend 30 years of their time at the source. Even though this scenario is unlikely, it provides a conservative baseline to avoid underestimation of risks. The industrial scenario assumes that the site would continue to be used for industrial purposes and that workers would spend 25 years of continuous employment at the site. Tables 4-2 and 4-3 identify the potential exposure routes evaluated for the Human Health Risk Assessment. It was determined that the industrial scenario would be appropriate for these source areas for the land use purposes. For groundwater, the future residential use scenario is used to represent the impacted drinking water supply aquifer and potential consumption.

4.2.1.2 Exposure Pathways and Assumptions

An exposure pathway is the mechanism by which chemicals migrate from their source or point of release to the population at risk. A complete exposure pathway comprises four elements: a source of a chemical release, transport of contaminants through environmental media, a point of potential human contact with a contaminated medium, and entry into the body or exposure route.

The exposure pathways considered in the Baseline Human Health Risk Assessment varied depending on the land use and population potentially exposed. The exposure assessment identified potential pathways for contaminants of concern to reach the exposed population for each source area. A "complete" exposure pathway must exist for a contaminant to pose a potential human health risk (i.e., the potential receptor to be exposed to a contaminant must exist).

4.2.1.3 Calculation of Exposure

EPA's Superfund guidance requires that the reasonable maximum exposure be used to calculate potential health impacts at Superfund sites. The reasonable maximum exposure is the highest exposure that is reasonably expected to occur at the source areas and is calculated using conservative assumptions in order to represent exposures that are reasonable and protective. The Baseline Human Health Risk Assessment reasonable maximum and average exposures were estimated for the residential and industrial land use scenarios. Average exposures were calculated to represent exposures of a more typical person.

To estimate exposure, data regarding the concentrations of contaminants of concern in the media of concern at the source area (the exposure point concentrations) are combined with information about the projected behaviors and characteristics of the people who potentially may be exposed to these media (exposure parameters). These elements are described below:

a) Exposure Point Concentrations. Surface soil (0 feet to 2 feet BGS), subsurface soil (2 feet to 12 feet BGS), and groundwater sample results for the DRMO Yard were averaged to calculate exposure point concentrations for the reasonable maximum exposure and average exposure calculations. At the DRMO Yard, two wells were selected from three areas (Area 1, Area 2, and Area 3) within the source area to be evaluated to ensure that the risks associated with "hot spots" were considered. Data from these areas were averaged to provide the reasonable maximum exposure. Because contaminant release occurred through a subsurface leach well at Building 1168, only subsurface soil contamination exists. Therefore, surface soil, sediment, and air exposure pathways risks were not calculated. Groundwater exposure point concentrations were calculated. Tables 4-4 through 4-7 contain exposure point concentrations for carcinogenic and noncarcinogenic contaminants of concern at both source areas. The exposure point concentrations were calculated on the arithmetic mean as the data (average) and as the 95% upper confidence level of the arithmetic mean of the data (reasonable maximum exposure).

   Note: A value of one-half the detection limit was used for nondetect concentrations for soil and groundwater to calculate the exposure point concentration. Because of the large number of nondetects (between 75% and 95% of the samples for many chemicals), the calculated 95% upper confidence limits (UCLs) are generally representative of the mean concentration. In addition, the maximum detected concentration for many chemicals was often only one to two orders of magnitude greater than the mean concentration. This finding indicates that, in general, there was not a wide variability in the distribution of chemicals in the different media. Because of these reasons, the 95% UCLs for many of the chemicals detected in soil and groundwater at OU-2 are not substantially different from the mean concentration.

b) Exposure Parameters. The parameters used to calculate the reasonable maximum exposure include body weight, age, contact rate, frequency of exposure, and exposure duration. Exposure parameters were obtained from EPA, Region 10, Risk Assessment guidance (*Region 10, Supplemental Risk Assessment Guidance for*

Superfund [EPA 1991]). The default exposure factors were modified to reflect site-specific climatological and other factors at Fort Wainwright. Site-specific exposure assumptions were made for soil contact, including ingestion, dermal contact, and inhaling dust, based on snow cover half the year.

For all of the media, exposures were estimated assuming long-term exposures to source area contaminants.

4.3 TOXICITY ASSESSMENT

The baseline human health evaluation provides toxicity information for the chemicals of concern. Generally, cancer risks are calculated using toxicity factors known as *slope factors*, while noncancer risks rely on reference doses.

EPA developed slope factors for estimating lifetime cancer risks associated with exposure to potential carcinogens. Slope factors are expressed in units of (milligrams per kilogram [mg/kg]-day^{-1}) and are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day^{-1}, to provide an upperbound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term *upperbound* reflects the conservative estimate of the risks calculated from the slope factor. Use of this approach makes it highly unlikely that the actual cancer risk would be underestimated. Slope factors are derived from the results of human epidemiological studies or chronic animal bioassays to which mathematical extrapolations from high to low dose and from animal to human dose have been applied.

Reference doses were developed to indicate the potential for adverse health effects from ingestion of potential contaminants of concern that exhibit such noncancer effects as damage to organ systems (e.g., the nervous system and blood forming system). Reference doses also are expressed in units of mg/kg-day and are estimates within an order of magnitude of lifetime daily exposure levels for people, including sensitive individuals, who are likely to be without risk of adverse effect. Estimates of intakes of contaminants of concern from environmental media (e.g., the amount of a contaminant of concern ingested from contaminated drinking water) can be compared to the reference dose. Reference doses are derived from human epidemiological studies and from animal studies to which uncertainty factors have been applied.

The toxicity factors were drawn from the Integrated Risk Information System or, if no Integrated Risk Information System values were available, from the Health Effect Assessment Summary Tables. For chemicals that do not have toxicity values available, other criteria, such as state and federal MCLs, were used to assess potential hazards or to determine action levels.

4.4 RISK CHARACTERIZATION

The purpose of the risk characterization is to integrate the results of the exposure and toxicity assessments to estimate risk to humans from exposure to site contaminants. Risks were calculated for carcinogenic (cancer-causing) and noncarcinogenic (toxic) effects based on the reasonable maximum exposure (see Section 4.2). To estimate cancer risk, the slope factor is multiplied by the exposure expected for that chemical to provide an upperbound estimate of

the excess lifetime cancer risk. This estimate is the incremental probability of an individual developing cancer over a lifetime as a result of exposure to cancer-causing chemicals at a source area. EPA considers excess lifetime cancer risks between 1 in 1 million (1×10^{-6}) and 1 in 10,000 (1×10^{-4}) to be within the generally acceptable range; risks greater than 1 in 10,000 usually suggest the need to take action at a site.

In defining effects from exposure to noncancer-causing contaminants, EPA considers acceptable exposure levels as those that do not adversely affect humans over their expected lifetime, with a built-in margin of safety. Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as a hazard quotient, which is the ratio of the estimated exposure from a site contaminant to that contaminant's reference dose. If the hazard quotient is less than 1, then adverse noncancer health effects are unlikely to occur. Hazard quotients for individual contaminants of concern are summed to yield a hazard index for the sub-area. The potential excess lifetime cancer risks and hazard indices described in this summary were calculated using reasonable maximum exposure assumptions.

Under current land use conditions, the estimates of carcinogenic and noncarcinogenic effects for the DRMO Yard fell within or below the EPA acceptable risk range for CERCLA sites. A current land use scenario was not evaluated for the Building 1168 Leach Well because there were no complete exposure pathways.

The future land use for both source areas is considered to be industrial. However, a residential scenario for groundwater is considered appropriate and representative of risk to current downgradient users, given DRMO Yard and Building 1168 Leach Well site hydrological conditions and the presence of the potable water supply/fire suppression well within the DRMO Yard. When considering groundwater as a source of domestic water, manganese was detected in groundwater at concentrations above EPA's acceptable risk range at the Building 1168 Leach Well. However, the manganese concentrations detected at the Building 1168 Leach Well are considered reflective of background concentrations in this mineral-rich area and are consistent with concentrations found in other source areas throughout Fort Wainwright.

Excess lifetime incremental cancer risks and hazard indices for both source areas are summarized in Tables 4-8 and 4-9. The incremental risks and hazard indices are calculated after subtracting the background concentrations of inorganics.

While soil contaminant concentrations do not pose a hazard for direct human contact, the levels are high enough to pose an ongoing threat to groundwater. Existing groundwater contaminant concentrations exceed state and federal MCLs.

4.4.1 Defense Reutilization and Marketing Office Yard

Excess lifetime incremental cancer risks for soil are below the 1 in 10,000 to 1 in 1 million risk range at the DRMO Yard, with the exception of benzo(a)pyrene, which is within the EPA acceptable risk range. Incremental hazard indices for soil at the DRMO Yard are less than 1. Arsenic was the main contaminant responsible for exceedance of an excess lifetime cancer risk of 1×10^{-6} for site workers and future residents. The average background concentration of arsenic in soil is higher than the estimated surface soil reasonable maximum exposure,

indicating that the arsenic risk for soil is attributable to background concentrations.

Excess incremental lifetime cancer risks for groundwater are below or within EPA's acceptable risk range of 1 in 10,000 to 1 in 1 million at the DRMO Yard. However, groundwater near the DRMO Yard groundwater supply/fire suppression well is contaminated with PCE at concentrations approaching unacceptable excess lifetime cancer risks (8.7×10^{-5}). VOCs are the contaminants responsible for exceedance of a 1×10^{-6} risk for future residential use of groundwater. The incremental hazard index for groundwater at the DRMO Yard is less than 1.

State and federal MCLs for PCE and TCE are exceeded consistently in sub-area DRMO1 groundwater. State and federal MCLs for benzene and PCE are exceeded in sub-area DRMO4 groundwater.

4.4.2 Building 1168 Leach Well

Excess lifetime incremental cancer risks for groundwater are below or within the 1 in 10,000 to 1 in 1 million risk range at the Building 1168 Leach Well. Arsenic was the main contaminant responsible for exceedance of an excess lifetime cancer risk of 1×10^{-6}.

The average incremental hazard index for future groundwater use is less than 1; however, the reasonable maximum exposure hazard index is 7.8. Manganese is the main contaminant contributing to the elevated hazard index. However, manganese was not used and was not a by-product of any process conducted at the Building 1168 Leach Well.

4.5 MAJOR UNCERTAINTIES

Uncertainty is associated with every step of the Risk Assessment process. The main uncertainty associated with the OU-2 Human Health Risk Assessment process that could result in overly conservative risk evaluation is summarized below:

- EPA recommends use of a default value of 30 years for residential exposure; however, most military assignments are for a much shorter period of time, often only one to three years.

Uncertainties that may underestimate site-related risk and exposures include the following:

- As a result of a data review reported by one laboratory, many pesticide and PCB data points were rejected for data quality reasons. However, these rejections do not appear to significantly affect the Risk Assessment; and

- Some of the analyses performed (diesel-range organics, gasoline-range organics, and total petroleum hydrocarbons) do not provide chemical-specific data; therefore, associated risks could not be quantified. However, surrogate chemicals were evaluated.

Uncertainties with unknown effects on the outcome of the Human Health Risk Assessment include the following:

- Multiple laboratories were used to analyze OU-2 samples, which can lead to inconsistencies in approach and can introduce errors or laboratory artifacts not easily identified;

- Surrogate toxicity factors were used to evaluate the potential risk associated with structurally similar chemicals that lack EPA-verified toxicity factors (e.g., naphthalene was used as a surrogate for methylnaphthalene). However, it was impossible to identify appropriate surrogates for all chemicals lacking verified toxicity factors. Therefore, certain chemicals were not evaluated in the Risk Assessment.

- The quality assurance/quality control process identified some concerns with regard to analytical results for organochlorine and organophosphorus pesticide samples. After data concerns were raised for OU-2 pesticide analytical results, separate independent reviews of the data were conducted by the Army; United States Army Engineer District, Alaska; and EPA. While the conclusions of both reviews indicate that the data are usable and consistent with other quality assurance laboratory analyses, uncertainty remains. However, to provide perspective, the action/no action decisions in this Record of Decision would not change even if the results were an order of magnitude different than those reported. The variability of results Is not expected to exceed this estimate, even under worst-case conditions.

Because numerous conservative assumptions were used in the selection of contaminants of concern and the exposure and toxicity assessments, the risk characterization results likely overestimate risks associated with contaminants of concern at OU-2.

4.6 ECOLOGICAL RISKS

An Ecological Risk Assessment addresses the impacts and potential risks posed by contaminants to natural habitats, including plants and animals, in the absence of remedial action. The three main phases of the Ecological Risk Assessment are problem formulation, analysis, and risk characterization.

The following sections present a brief discussion of the Ecological Risk Assessment steps.

4.6.1 Problem Formulation

To narrow the scope and to focus the Ecological Risk Assessment on the most important aspects of OU-2, a number of steps was performed. An ecological survey was conducted at the DRMO Yard and Building 1168 Leach Well. In addition, previous ecological investigations, including wildlife inventories, were reviewed. A description of the regional and local ecology was completed, and threatened, endangered, sensitive, or rare species were

identified.

Chemicals of potential ecological concern were identified by a review of the OU-2 analytical database with regard to data quality, spatial representation and adequacy for an Ecological Risk Assessment, comparison to background concentrations, and comparison to ecological risk-based criteria for sediment and surface water. Next, pathways of contaminant migration exposure were identified by an evaluation of sources of contaminants and the mechanisms by which they may be transported to media of ecological concern, plants, and animals.

Potential ecological effects are summarized by a review of the toxicological literature. These summaries present a review of the known toxicological effects of the chemicals of potential ecological concern on wildlife species.

Two types of ecological end points are considered in the Ecological Risk Assessment: assessment and measurement end points:

- Assessment end points are qualitative or quantitative expressions of the environmental values to be protected at OU-2 and are selected by consideration of species that play important roles in community structure or function; species of societal significance or concern; species of concern to federal and state agencies; diet, habitat preference, and behaviors that predispose the species to chemicals of potential ecological concern exposure; amenability of the selected species to measurement or prediction of effects; and species that may be particularly sensitive to the chemicals of potential ecological concern identified at OU-2; and

- Measurement end points include the species and communities used to quantify the potential ecological impacts posed by OU-2 chemicals of potential ecological concern. Representative measurement species are selected based on the relative abundance of each species and establishment of functional groups based on trophic level and preferred habitat. Representative indicator species then are selected based on the potential for exposure and the availability of toxicological data. The following measurement species and communities were selected for evaluation at OU-2: meadow voles, muskrats, and benthic invertebrates.

A conceptual ecological exposure model is formulated and defines the receptors and pathways to be evaluated in the Ecological Risk Assessment. The refined conceptual ecological exposure models for OU-2 are potential ecological risks that may result from exposure of terrestrial wildlife and vegetation to chemicals of potential ecological concern found in the surface soils at the DRMO Yard and from exposure of benthic invertebrates to sediments and surface water associated with the DRMO Yard. No complete ecological exposure pathways associated with the Building 1168 Leach Well were identified; therefore, the source area was not evaluated further.

4.6.2 Analysis

The analysis phase of the Ecological Risk Assessment evaluates receptor exposure to chemicals of potential ecological concern and the potential adverse effects of that exposure. Analysis of exposure and effects is based on the ecological end points and the refined conceptual ecological exposure site model derived during the problem formulation phase. Analysis comprises two main components:

- Exposure assessment, in which exposure point concentrations and chemical of potential ecological concern intakes for the measurement species are estimated; and

- Ecological effects assessment, in which toxicity benchmark values are derived from the literature and toxicological databases, and uncertainty factors are selected and applied to the toxicity benchmark values to yield toxicity reference values. The uncertainty factors are used to compensate for applying data derived from laboratory or domestic animal studies to free-ranging wildlife (for which little empirical data are available).

4.6.3 Risk Characterization

Risk characterization involves two major components: risk estimation and risk description.

4.6.3.1 Risk Estimation

Risk estimation involves calculating hazard quotients to assess potential ecological risks to measurement species and communities. This method involves comparing calculated exposure doses or media concentrations with toxicity reference values and/or experimentally derived risk-based concentrations. Ecological effects are quantified by calculating the ratio between a chemical of potential ecological concern's estimated intake or concentration and its corresponding toxicity reference value (i.e., the intake level or concentration at which no adverse ecological effects are expected to occur). If this ratio (i.e., the hazard quotient) exceeds 1, then adverse ecological effects may be expected for the chemical of potential ecological concern. The hazard quotients described in this summary were calculated using conservative reasonable maximum exposure assumptions.

The hazard quotients for each exposure pathway (e.g., soil ingestion and surface water ingestion) may be summed for each chemical of potential ecological concern to establish chemical-specific hazard indices for each measurement species. The hazard indices provide a species- and chemical-specific characterization of the potential ecological risks across all of the assessed exposure pathways. Finally, the hazard indices can be added across contaminants that have similar effects.

4.6.3.2 Risk Description

Risk description involves summarizing the ecological significance of the potential risks and presenting the uncertainties associated with the Ecological Risk Assessment.

The results of the Ecological Risk Assessment for OU-2 indicate a potential for adverse effects to small terrestrial mammals (e.g., voles) at the DRMO Yard, reflecting ecologically significant concentrations of manganese and lead. These risks are associated with ingestion of soil and vegetation. These contaminants do not appear to be associated with historical source area activities and are consistent with regional background concentrations. Additionally, the DRMO Yard is an industrial area with a significant amount of heavy equipment and human activity. The habitat area in these locations has been altered significantly from the surrounding land. Specific species surveys and traps were not used. The actual number of animals that could be affected by these chemicals could be very low.

At the DRMO Yard drainage ditches, muskrats may be impacted by lead, manganese, arsenic, dioxin, and PCBs present in the sediments; however, the east drainage ditch containing the PCBs and dioxins was excavated in 1995. For the purposes of the Ecological Risk Assessment, it was assumed that the muskrat would remain year-round in the surface water bodies at the DRMO Yard. This is a conservative assumption because muskrats are known to migrate to larger water bodies during winter, when smaller water bodies freeze. Therefore, the risk is overestimated. In addition, impacts to the muskrat population are not expected because the affected areas are limited in size.

Sediment quality criteria are a measure of the potential adverse effects to benthic invertebrates. Organic chemicals of potential ecological concern, lead, and cadmium exceed the sediment quality criteria in the east ditch. However, the east ditch is dry throughout most of the year and therefore does not support aquatic life. In addition, this ditch was excavated in 1995. Although the sediment quality criteria were exceeded for arsenic, manganese, and lead in Channel B and the north channel at the DRMO Yard, the origin of these inorganic chemicals is assumed to be attributable mainly to a combination of naturally occurring concentrations, contributions from other anthropogenic sources, and diffuse nonpoint source input from the DRMO Yard source area.

Overall, there do not appear to be unacceptable potential ecological risks associated with the DRMO Yard source area.

The Ecological Risk Assessment is subject to uncertainties because virtually every step in the Risk Assessment process involves assumptions using professional judgment. Principal uncertainties associated with the OU-2 Ecological Risk Assessment include the following:

- Site and media with incomplete exposure pathways were eliminated from evaluation;
- For terrestrial species, the risks were estimated using average site chemical concentrations in soil between 0 feet and 2 feet BGS and modeled chemical concentrations in plants for the meadow vole;
- For aquatic species, risks were estimated by calculating hazard indices for muskrats potentially exposed to chemicals of potential ecological concern in sediments and plants, and by evaluating the potential adverse effects to benthic invertebrates by comparing sediment chemicals of potential ecological concern to sediment quality criteria;

- Sampling was biased toward areas of "expected" soil contamination. This is likely to result in an overestimation of potential risks to the OU-2 ecological receptors;

- Conservative assumptions were used in estimating exposures and in developing the contaminant screening criteria (such as using the lowest no observed adverse effect level value from the literature), which tend to overestimate risks;

- Indicator species were selected on the basis of likelihood of exposure to contaminants. Exposure of other terrestrial and aquatic receptors is not expected to exceed these risks. Conservative assumptions were used in the selection of the indicator species to minimize the potential for underestimating the exposure to other unevaluated receptors;

- Exposure parameters for all measurement species were selected based on professional judgment. Assumptions included the following: that chemicals do not degrade, terrestrial receptors are exposed chronically to the mean concentration of all chemicals of potential ecological concern in soil and sediment, receptors spend their lifetime within the contaminated portion of the site, contaminants are absorbed completely via all evaluated exposure routes, chemicals do not combine to form new chemicals, and plant uptake modeling accurately describes chemical uptake in plants. Without extensive site-specific field data, it is unclear whether potential risks are underestimated or overestimated using the selected exposure parameters;

- Assumptions used in the effects assessment include the following: use of animal data can be extrapolated across species, laboratory species have sensitivity to chemicals of potential ecological concern similar to species in the natural environment, data for reproductive and development end points can predict impacts to populations, oral exposure toxicity values can be used to evaluate dermal exposure, indicator species are as sensitive to the toxic effects of chemicals of potential ecological concern as the other species on site, and the toxicity benchmarks adequately address the potential toxicity of chemicals of ecological concern to relevant species. It is unclear whether these assumptions overestimate or underestimate potential risks; and

- Chemicals with different target organs and end points add linearly to potential risks. This assumption probably results in an overestimation of risk.

The approach described in this Ecological Risk Assessment uses realistic assumptions wherever possible; reasonable and conservative assumptions were used when empirical data were unavailable. Consequently, potential ecological risks to OU-2 species are more likely to be overestimated rather than underestimated.

Table 4-1

CONTAMINANTS OF CONCERN IN SOIL AND GROUNDWATER FROM THE HUMAN HEALTH RISK ASSESSMENT OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

Chemical	Source Area		
	DRMO Yard		Building 1168 Leach Well
	Groundwater	Soil	Groundwater
Aroclor 1260		X	
Arsenic		X	X
Barium	X		X
Benzene	X		X
Benzo(a)anthracene		X	
Benzo(a)pyrene		X	
Benzo(b)fluoranthene		X	
n-Butylbenzene	X		X
sec-Butylbenzene	X		X
Cadmium		X	
Chloroform	X		
Chromium	X		
4,4'-DDT		X	
1,2-Dichlorobenzene	X		
1,1-Dichlorobenzene	X		
1,2-Dichloroethane	X		
1,2(cis)-Dichloroethene	X		
Dieldrin		X	
Diesel-range organics	X	X	X
Disulfoton	X		
Ethylbenzene			X
Gasoline-range organics	X	X	X
Indeno(1,2,3-cd)pyrene		X	
Lindane		X	
Manganese	X	X	X

Key at end of table.

Table 4-1

CONTAMINANTS OF CONCERN IN SOIL AND GROUNDWATER FROM THE HUMAN HEALTH RISK ASSESSMENT OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

Chemical	Source Area		
	DRMO Yard		Building 1168 Leach Well
	Groundwater	Soil	Groundwater
Mercury		X	
Methylene chloride	X		
2-Methylnaphthalene	X		
2,3,7,8-TCDD (as TEQs)	X	X	
Tetrachloroethene	X		
Toluene			X
Trichloroethene	X		X
o-Xylene	X		X

Key:

DDT = Dichlorodiphenyldichloroethane.
DRMO = Defense Reutilization and Marketing Office.
TCDD = Tetrachlorodibenzo-p-dioxin.
TEQs = Toxicity equivalencies.
X = Indicates that the chemical was selected as a chemical of concern for the specific site and media shown.

Table 4-2

POTENTIAL EXPOSURE ROUTES
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA

Exposure Medium and Route	Potentially Exposed Populations				
	Current Worker	Future Worker	Future Resident	Future Construction Worker	Future Site Visitor
Groundwater					
Ingestion	X	X	X	—	—
Dermal contact	X	X	X	—	—
Air					
Inhalation of VOCs	—	—	X	—	—
Inhalation of particulates	X	X	—	—	—
Soil					
Ingestion	X	X	—	—	—
Dermal contact	X	X	—	—	—

Key:

— = Exposure of this population through this route is not likely to occur.
DRMO = Defense Reutilization and Marketing Office.
VOCs = Volatile organic compounds.
X = Exposure of this population through this route is probable.

Table 4-3

POTENTIAL EXPOSURE ROUTES
BUILDING 1168 LEACH WELL SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA

Exposure Medium and Route	Potentially Exposed Populations			
	Future Worker	Future Resident	Future Construction Worker	Future Site Visitor
Groundwater				
Ingestion	—	X	—	—
Dermal contact	—	X	—	—
Air				
Inhalation of VOCs	—	X	—	—

Key:

— = Exposure of this population through this route is not likely to occur.
VOCs = Volatile organic compounds.
X = Exposure of this population through this route is probable.

Table 4-4

EXPOSURE POINT CONCENTRATION AND STATISTICAL SUMMARY CHEMICALS OF POTENTIAL CONCERN SURFACE SOIL AT THE DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (mg/kg)

Chemical	Sitewide Average Concentration	Maximum Detected Concentration	Standard Deviation	RME 95% UCL
1,3,5-Trimethylbenzene	0.004	0.12	0.013	0.006
4,4'-DDT	0.055	1.1	0.0129	0.079
Aroclor 1260	0.113	1.1	0.156	0.143
Arsenic	8.37	72.4	7.904	9.85
Benzo(a)anthracene	0.150	0.32	58.557	160.97
Benzo(a)pyrene	0.153	0.35	60.802	164.77
Benzo(b)fluoranthene	0.125	0.35	57.736	136.31
Cadmium	0.68	8.1	1.044	0.88
Dieldrin	0.014	1.0	113.058	35.66
Diesel-range organics	55.682	2,000	251.039	103.402
Gasoline-range organics	4.62	130	15.098	7.49
Indeno(1,2,3-cd)pyrene	0.098	0.2	0.046	0.106
Lead	35.46	996	111.649	56.27
Lindane	0.002	0.004	0.0007	0.002
Manganese	263.56	440	77.887	278.27
Mercury	0.05	0.32	0.040	0.06
p-Isopropyltoluene	0.003	0.051	0.006	0.004
Thallium	0.12	0.13	0.027	0.12
2,3,7,8-TCDD (TEQs)	2.54 pg/g	97.4 pg/g	11.460	4.77 pg/g

Note: The average and RME concentrations represent the arithmetic mean and the 95% UCL calculated on the sitewide surface soil data.

Key:

95% UCL = 95% upper confidence limit on the arithmetic mean.
DDT = Dichlorodiphenyldichloroethane.
DRMO = Defense Reutilization and Marketing Office.
mg/kg = Milligrams per kilogram.
pg/g = Picograms per gram.
RME = Reasonable maximum exposure.
TCDD = Tetrachlorodibenzo-p-dioxin.
TEQs = Toxicity equivalencies.

Table 4-5

EXPOSURE POINT CONCENTRATION AND STATISTICAL SUMMARY CHEMICALS OF POTENTIAL CONCERN SUBSURFACE SOIL AT THE DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (mg/kg)

Chemical	Sitewide Average Concentration	Maximum Detected Concentration	Standard Deviation	RME 95% UCL
1,3,5-Trimethylbenzene	0.0543	5.600	0.457	0.104
4,4'-DDT	0.0120	0.380	0.029	0.015
Aroclor 1260	0.0790	0.590	0.047	0.085
Arsenic	5.38	19.6	3.643	5.78
Benzo(a)anthracene	0.0409	0.045	0.009	0.042
Benzo(a)pyrene	0.0441	0.049	0.011	0.045
Benzo(b)fluoranthene	0.0432	0.048	0.010	0.044
Cadmium	0.42	2	0.311	0.46
Dieldrin	0.0016	0.013	0.001	0.002
Diesel-range organics	114.19	9,600	732.435	194.586
Gasoline-range organics	16.04	690	63.206	22.98
Lead	7.59	130	9.326	8.60
Lindane	0.004	0.130	0.009	0.004
Manganese	235.89	2,420	210.473	258.88
Mercury	0.06	2.3	0.152	0.07
p-Isopropyltoluene	0.025	2.200	0.172	0.044
Thallium	2.24	9.8	1.388	2.39
2,3,7,8-TCDD (TEQs)	0.350 pg/g	1.73 pg/g	1.914	0.584

Note: The average and RME concentrations represent the arithmetic mean and the 95% UCL calculated on the sitewide subsurface soil data.

Key:

95% UCL = 95% upper confidence limit on the arithmetic mean.
DDT = Dichlorodiphenyldichloroethane.
DRMO = Defense Reutilization and Marketing Office.
mg/kg = Milligrams per kilogram.
pg/g = Picograms per gram.
RME = Reasonable maximum exposure.
TCDD = Tetrachlorodibenzo-p-dioxin.
TEQs = Toxicity equivalencies.

Table 4-6

EXPOSURE POINT AND STATISTICAL SUMMARY OF CHEMICALS OF POTENTIAL CONCERN FOR GROUNDWATER AT THE DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

(µg/L)

Chemical	Sitewide Average Concentration	Maximum Detected Concentration	Standard Deviation	RME 95% UCL	RME Area 1	RME Area 2	RME Area 3
1,2,4-Trimethylbenzene	15.881	460	65.375	27.837	310.000	ND	1.15
1,2-Dichlorobenzene	2.962	38	3.805	3.462	ND	ND	ND
1,2-Dichloroethane	0.524	1.5	0.154	0.552	ND	ND	ND
1,3,5-Trimethylbenzene	6.845	130	22.937	11.04	95.500	ND	1.05
1,4-Dichlorobenzene	2.716	12	2.365	3.027	ND	ND	ND
2-Methylnaphthalene	15.539	240	39.433	23.084	155.000	1	ND
Barium (total)	176	1,200	150	205	255	165	705
Benzene	0.825	7.5	1.226	1.049	ND	ND	6.7
Butylbenzene(sec)	1.276	25	3.141	1.850	18.0	3.2	ND
Chloroform	1.218	8	1.537	1.449	1.100	ND	ND
Chromium (total)	25	510	69	39	ND	ND	160
cis-1,2-Dichloroethene	0.644	7.3	0.802	0.791	ND	ND	ND
Diesel-range organics	2,613	41,000	7,474	3,856	32,000	2,700	250
Disulfoton	0.122	1.3	0.146	0.150	ND	0.315	ND
Gasoline-range organics	531	28,000	3,113	1,104	14,470	250	235

Key at end of table.

Table 4-6

EXPOSURE POINT AND STATISTICAL SUMMARY OF CHEMICALS OF POTENTIAL CONCERN FOR GROUNDWATER AT THE DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (μg/L)

Chemical	Sitewide Average Concentration	Maximum Detected Concentration	Standard Deviation	RME 95% UCL	RME Area 1	RME Area 2	RME Area 3
Manganese (total)	1,648	13,000	1,822	1,997	8,000	3,150	950
Methylene chloride	0.885	8.8	1.220	1.109	ND	ND	ND
n-Butylbenzene	0.913	30	3.253	1.508	15.250	ND	ND
Naphthalene	16.786	530	64.905	25.306	204.000	ND	ND
o-Xylene	6.477	170	26.250	11.277	119.500	ND	ND
p-Isopropyltoluene	4.004	200	22.095	8.045	109.500	ND	ND
Tetrachloroethene	5.995	140	18.375	9.355	ND	102.5	26.8
Trichloroethene	1.857	17	2.884	2.385	ND	3.4	3.7
2,3,7,8-TCDD (TEQs)	9.30E-7	8.65E-6	1.599	1.21E-6	4.30E-7	1.24E-6	9.11E-7

Notes: Area 1 RME represents the average of monitoring wells P34 and AP-5825, the wells with the highest number of maximum detections.

Area 2 RME represents the average of monitoring wells MW4 and P46, the area of maximum tetrachloroethene concentrations.

Area 3 RME represents the average of monitoring wells P04 and P05, the area of maximum benzene concentrations.

Key at end of table.

Table 4-6 (Cont.)

Key:

95% UCL = 95% upper confidence limit on the arithmetic mean.
COPC = Chemical of potential concern.
DRMO = Defense Reutilization and Marketing Office.
µg/L = Micrograms per liter.
ND = Not detected.
RME = Reasonable maximum exposure.
TCDD = Tetrachlorodibenzo-p-dioxin.
TEQs = Toxicity equivalencies.

Table 4-7

EXPOSURE POINT CONCENTRATION AND STATISTICAL SUMMARY OF CONTAMINANTS OF POTENTIAL CONCERN FOR GROUNDWATER AT BUILDING 1168 LEACH WELL OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (µg/L)

Chemical	Sitewide Average Concentration	Maximum Detected Concentration	Standard Deviation	RME 95% UCL
1,2,4-Trimethylbenzene	95.22	350	145.940	234.368
1,3,5-Trimethylbenzene	40.78	150	62.427	100.302
Arsenic	8.63	27	103	185
Barium	238	350	0.100	0.334
Benzene	2.12	5.1	1.733	3.772
Diesel-range organics	7,316	34,000	14,940	21,561
Ethylbenzene	87.32	310	130.681	211.919
Gasoline-range organics	4,365	18,000	7,669	11,677
Manganese (dissolved)	1,682	4,400	1,716.601	3,318.710
n-Butylbenzene	6.77	16	7.557	13.975
o-Xylene	201.62	1,000	446.309	627.158
p-Isopropyltoluene	11.24	30	11.903	22.589
sec-Butylbenzene	4.8	11	4.139	8.747
Toluene	154.8	770	343.907	482.702
Trichloroethene	5.56	23	9.749	14.856

Notes: Both the average and RME concentrations represent the arithmetic mean and the 95% UCL of the five wells located closest to the leach well: AP-5747, -5751, -5752, -5754, and -6332.

Although cadmium was retained as a COPC based on the screening for all wells at Building 1158, cadmium was not detected in any of the five wells included in the EPC calculations.

Key:

95% UCL = 95% upper confidence limit on the arithmetic mean.
COPC = Chemical of potential concern.
EPC = Exposure point concentration.
µg/L = Micrograms per liter.
RME = Reasonable maximum exposure.

Table 4-8

SUMMARY OF INCREMENTAL CARCINOGENIC RISKS AND NONCARCINOGENIC HAZARD INDICES FOR POTENTIALLY EXPOSED POPULATIONS AT THE DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

Receptor/Pathway	Carcinogenic Risks		Noncarcinogenic Hazard Indices	
	Average	RME	Average	RME
Surface soil ingestion	1.9E-08	3.4E-07	1.1E-04	6.9E-04
Surface soil dermal contact	1.0E-08	1.2E-06	3.3E-05	1.9E-03
Total	3.0E-08	1.5E-06	1.4E-04	2.6E-03
Future Resident—Sitewide				
Surface soil ingestion	4.6E-07	3.1E-06	8.4E-04	5.3E-03
Surface soil dermal contact	7.0E-09	2.0E-06	2.5E-05	2.8E-03
Total	4.7E-07	5.1E-06	8.6E-04	8.1E-03
Future Resident—Sitewide				
Groundwater ingestion	5.5E-07	1.0E-05	3.4E-02	7.1E-01

Notes: Incremental risks are presented for only those receptors exceeding a total risk of 10^{-6} or a total hazard index of 1.0. Incremental risks are not presented for the three areas with elevated chemical concentrations.

Incremental risks are calculated after subtracting the background concentrations of inorganics.

Arsenic was not a chemical of potential concern in groundwater. Therefore, the groundwater-related incremental risks are identical to the total risks.

The soil and groundwater for OU-2 source areas was reviewed to identify whether hotspots (ares with chemical concentrations significantly elevated above that detected across the rest of the site) were present. There were no clearly discernible hotspots in soil at the DRMO Yard. Three potential groundwater hotspots were identified at the DRMO Yard. Data from two monitoring wells at each hotspot were evaluated independently from the sitewide groundwater database. The Area 1 hotspot included 19 of the maximum detected groundwater concentrations at the DRMO Yard. Areas 2 and 3 represented PCE and benzene hotspots, respectively. Potential human health risks associated with exposure to these hotspots was evaluated separately. Eleven monitoring wells were sampled during the RI at the Buidling 1168 source area. A subset of the five wells closest to the leachfield source were evaluated in the Risk Assessment. The other six wells were somewhat distant from the Buidling 1168 source area and did not appear to be impacted significantly by source area chemicals. As a result, the Risk Assessment is based on a grouping of wells that represent the highest concentrations from the Building 1168 source area. Exposure to soil at Building 1168 was not evaluated in the Risk Assessment because of the nature of the release (into deep subsurface soil) and the limited soil data collected during the RI.

Table 4-8 (Cont.)

Key:

DRMO = Defense Reutilization and Marketing Office.
OU = Operable Unit.
PCE = Tetrachloroethene.
RI = Remedial Investigation.
RME = Reasonable maximum exposure.

Table 4-9

SUMMARY OF INCREMENTAL CARCINOGENIC RISKS AND NONCARCINOGENIC HAZARD INDICES FOR POTENTIALLY EXPOSED POPULATIONS AT BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

Receptor/Pathway	Carcinogenic Risks		Noncarcinogenic Hazard Indices	
	Average	RME	Average	RME
Future Resident				
Groundwater ingestion	1.1E-07	3.2E-06	2.0E-02	7.5E+00
Groundwater dermal contact	3.2E-11	3.6E-10	2.0E-05	7.6E-05
Groundwater inhalation of VOCs	8.4E-08	2.3E-06	2.7E-02	2.8E-01
Total	1.9E-07	5.5E-06	4.7E-02	7.8E+00

Note: Incremental risks are calculated after subtracting the background concentrations of inorganics.

The soil and groundwater for OU-2 source areas was reviewed to identify whether hotspots (ares with chemical concentrations significantly elevated above that detected across the rest of the site) were present. There were no clearly discernible hotspots in soil at the DRMO Yard. Three potential groundwater hotspots were identified at the DRMO Yard. Data from two monitoring wells at each hotspot were evaluated independently from the sitewide groundwater database. The Area 1 hotspot included 19 of the maximum detected groundwater concentrations at the DRMO Yard. Areas 2 and 3 represented PCE and benzene hotspots, respectively. Potential human health risks associated with exposure to these hotspots was evaluated separately. Eleven monitoring wells were sampled during the RI at the Buidling 1168 source area. A subset of the five wells closest to the leachfield source were evaluated in the Risk Assessment. The other six wells were somewhat distant from the Buidling 1168 source area and did not appear to be impacted significantly by source area chemicals. As a result, the Risk Assessment is based on a grouping of wells that represent the highest concentrations from the Building 1168 source area. Exposure to soil at Building 1168 was not evaluated in the Risk Assessment because of the nature of the release (into deep subsurface soil) and the limited soil data collected during the RI.

Key:

OU = Operable Unit.
PCE = Tetrachloroethene.
RI = Remedial Investigation.
RME = Reasonable maximum exposure.
VOCs = Volatile organic compounds.

5.0 DESCRIPTION OF ALTERNATIVES

5.1 NEED FOR REMEDIAL ACTION

Remedial actions were deemed necessary with respect to groundwater at the DRMO Yard and Building 1168 Leach Well to comply with state and federal MCLs.

Actual or threatened releases of hazardous substances from the DRMO Yard and Building 1168 Leach Well source areas, if not addressed, may present substantial endangerment to public health, welfare, or the environment.

Groundwater is the only source of potable water for Fort Wainwright and surrounding communities. The aquifer is considered unconfined except in areas of permafrost. Additionally, the aquifer is considered highly transmissive, with large hydraulic conductivities. Remedial actions for soils were selected to remove volatile organic and petroleum compounds from the soils as quickly as possible in order to minimize soils acting as an ongoing source of contamination to the groundwater.

5.1.1 Defense Reutilization and Marketing Office Yard

The specific reasons for conducting remedial actions at the DRMO Yard source area are provided below, with the main focus being protection of groundwater:

- VOCs (i.e., benzene, PCE, and TCE) in groundwater at the DRMO Yard are present at concentrations above state and federal MCLs; and

- VOC- (e.g., PCE, benzene, and TCE) contaminated soils from unknown sources (within an identified area) are a continuing source of groundwater contamination, as discussed in the nature and extent section.

Petroleum-contaminated subsurface soils act as a continuing source of groundwater contamination because of shallow aquifer conditions and annual groundwater fluctuations. These contaminants are present at concentrations above State of Alaska cleanup levels for UST petroleum-contaminated soil.

Many chemicals were detected at the DRMO Yard; however, the above-listed VOCs and petroleum-related compounds were the only chemicals to exceed regulatory limits or to act as significant sources of risk to human health or the environment. Contamination related to petroleum, including DRO/GRO, has been referred to the Two-Party Agreement, except in instances where it is comingled with other contaminants of concern. Table 5-1 provides the rationale for discarding and retaining chemicals detected at the DRMO Yard source area.

5.1.2 Building 1168 Leach Well

The specific reasons for conducting remedial actions at the Building 1168 Leach Well source area are provided below, with the main focus being protection of groundwater:

- VOCs (benzene and TCE) in groundwater near the Building 1168 Leach Well are present at concentrations exceeded state and federal MCLs; and

- VOC-contaminated subsurface soils are a continuing source of groundwater contamination.

Petroleum-contaminated subsurface soils, including DRO/GRO, act as a continuing source of groundwater contamination because of shallow aquifer conditions and annual groundwater fluctuations. These contaminants are present at concentrations above State of Alaska cleanup levels for non-UST petroleum-contaminated soil.

Other chemicals were detected at the Building 1168 Leach Well source area; however, the above-listed VOCs and petroleum-related contaminants were the only chemicals to exceed regulatory limits or to act as significant sources of risk to human health or the environment. Table 5-2 provides the rationale for discarding and retaining chemicals detected at the Building 1168 Leach Well.

5.2 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are based on federal and state applicable or relevant and appropriate requirements (ARARs). All groundwater RAOs are based on state and federal MCLs. Soil RAOs are based on State of Alaska cleanup levels for non-UST petroleum contamination. The RAOs for the DRMO Yard and Building 1168 Leach Well are as follows:

Groundwater

- Restore groundwater to its beneficial use of drinking water quality within a reasonable time frame through source control;

- Reduce or prevent further migration of contaminated groundwater from the source areas;

- Prevent use of groundwater containing contaminants at levels above Safe Drinking Water Act and State of Alaska Drinking Water Standard MCLs and Alaska Water Quality Standards (AWQS), and limit high-volume pumping from the aquifer at the DRMO Yard until state and federal MCLs are achieved; and

- Use natural attenuation to attain AWQS (18 Alaska Administrative Code [AAC] 70) after reaching state and federal MCLs.

Soil

- Prevent migration of soil contaminants to groundwater, which could result in groundwater contamination and exceedances of state and federal MCLs and AWQS (18 AAC 70).

5.3 SIGNIFICANT APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

A full list of ARARs is in Section 8. The following ARARs are the most significant regulations that apply to the remedy selections for the DRMO Yard and Building 1168 Leach Well:

- State and federal MCLs are relevant and appropriate for groundwater. These set the active remediation goals for groundwater. AWQS (18 AAC 70) is also applicable; and

- Alaska oil pollution regulations (18 AAC 75) are applicable, and Alaska guidelines for non-UST petroleum-contaminated soil are to be considered. These guidelines require cleanup of petroleum-contaminated soils to protect groundwater quality.

5.4 DESCRIPTION OF ALTERNATIVES

5.4.1 Defense Reutilization and Marketing Office Yard

Preliminary remedial alternatives for the DRMO Yard are described below. Numerous assumptions had to be made to determine cleanup time frames. These include consistent contaminant concentrations in soil and groundwater, treatment efficiencies similar to the currently operating SVE/AS system, and consistent groundwater flow direction.

5.4.1.1 Alternative 1: No Action

The no-action alternative for the DRMO Yard source area involves no environmental monitoring, institutional controls, or remedial action and would leave the VOC-contaminated groundwater in its present state. The groundwater plume would continue to migrate in the direction of groundwater potentially migrating to the Chena River. Development of the no-action alternative is required by the NCP to provide a basis of comparison for the remaining alternatives, serving as a baseline reflecting current conditions without any cleanup effort. The no-action alternative was evaluated consistent with NCP requirements. No present worth, capital, operation and maintenance (O&M), or groundwater monitoring costs are associated with this no-action alternative.

5.4.1.2 Alternative 2: Institutional Controls and Natural Attenuation with Groundwater Monitoring/Evaluation

Institutional controls for the DRMO Yard source area would include land use and site access restrictions, and downgradient groundwater monitoring/evaluation that includes developing and implementing a long-term annual groundwater monitoring program for approximately eight wells (six existing and two new wells) for 30 years. Land use restrictions include limiting future use of the land to operations currently conducted at the DRMO Yard. Access restrictions include maintaining the existing fence around the DRMO Yard. Additional institutional controls would include a prohibition on refilling the DRMO Yard fire suppression tank from the existing potable water supply well until state and federal MCLs are met (except

in emergency situations). This restriction would effectively limit significant groundwater pumping from the aquifer, which could affect the existing groundwater contaminant plume.

The VOC-contaminated groundwater would remain as it exists at this source area, thereby not reducing contaminant concentrations other than through natural attenuation. However, institutional controls would decrease or minimize human exposure to contaminants. Periodic inspections and maintenance of the institutional controls would be conducted. Groundwater use restrictions would be incorporated into the Fort Wainwright Comprehensive Master Plan.

Natural attenuation or breakdown of contaminants occurs over time and is the reduction of contaminant concentrations in the environment through biological processes (aerobic and anaerobic biodegradation, and plant and animal uptake), physical phenomena (advection, dispersion, dilution, diffusion, volatilization, and sorption/desorption), and chemical reactions (ion exchange, complexation, and abiotic transformation). Remediation of VOC-contaminated soil and groundwater at the DRMO Yard source area by natural attenuation is expected to take more than 50 years.

Environmental monitoring and data evaluation would be performed periodically to obtain information regarding the effectiveness of the natural attenuation process in remediating the contamination, as well as to track the extent of contaminant migration from the site. To the extent practicable, this monitoring and evaluation will be conducted using six existing wells that are screened in geological zones hydraulically connected with the contamination source, supplemented by installing two groundwater monitoring wells when required. Upgradient wells would be used to provide information about the background groundwater quality at a source. Downgradient wells are used to monitor the extent of contaminant migration, change in flow direction, or occurrence of degradation products to protect downgradient drinking water wells.

Monitoring requirements would target VOCs, including the contaminants that were found to exceed the state and federal MCLs or their potential degradation products as specified in the RAOs for the DRMO Yard source area. To the extent practicable, monitoring data requirements will be coordinated or combined with those from other state or federal programs, such as RCRA and the Safe Drinking Water Act. Sample collection, analysis, and data evaluation would continue until sufficient data regarding changes in contaminant plume migration (including potential seasonal fluctuations in groundwater contaminant concentrations) and attenuation rates are gathered. The frequency of monitoring would be defined specifically during the Remedial Design phase. Changes to this remedy may be required as a result of the Remedial Design or construction phase. These changes will be addressed in the post-ROD documents.

The estimated present worth cost of this alternative is $180,000, which includes $34,000 for capital costs and $146,000 for annual groundwater monitoring, based on an estimated 30-year time frame for groundwater monitoring for cost estimating purposes (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation and flow direction). However, monitoring would occur until state and federal MCLs are achieved, which would be more than 30 years.

5.4.1.3 Alternative 3: Soil Vapor Extraction, Groundwater Air Sparging, Natural Attenuation, and Groundwater Monitoring/Evaluation

This alternative involves treatment of VOC-contaminated soils in place via SVE, on-site treatment of groundwater via AS with natural attenuation, and groundwater monitoring/evaluation.

The SVE/AS system will inject air below the groundwater table to promote movement of VOCs from subsurface soils and groundwater and to collect the vapors by applying a vacuum through a series of vapor extraction wells. The SVE/AS system would be installed to provide active treatment out to the 20-ppb isocontour of the defined groundwater plume (see Figure 5-1). Treatment beyond this isocontour out to the state and federal MCL of 5 ppb would be through natural attenuation, except for a line of curtain wells near Channel B to prevent contaminants from entering the surface water.

For cost analysis purposes, the major components of the enhanced SVE system are assumed to include approximately 21 driven-point extraction wells; below-ground, horizontal polyvinyl chloride (PVC) piping, valves, sampling ports, and vacuum gauges; 10 extraction blowers; an air/water separator with storage tank; and a heating system for the prefabricated buildings and SVE piping. The blowers would be housed in prefabricated buildings. The SVE system would consist of explosion-proof equipment and automatic safety devices that would deactivate the system if the treatment building interior atmosphere were to exceed 20% of the lower explosive limit. Treatment of exhaust gases will be accomplished by directing these gases through a granulated activated carbon filter unit or air mixing chamber if sampling results exceed regulatory limits. Any water extracted from the air/water separator would be collected in a drum or tank, treated via carbon filtration, and discharged to the sanitary sewer system. The major components of the AS system would include 62 driven-point sparging wells; below-grade, horizontal PVC piping; and 10 centrifugal injection blowers. Changes to this remedy may be required as a result of the Remedial Design phase. These changes will be addressed in post-ROD documents.

Air will be injected below the water table to strip volatiles from groundwater and soil in the saturated and unsaturated zones, respectively. Volatiles are purged to the unsaturated zone, where they will be collected in the vacuum extraction wells. In addition, the vacuum extraction wells create a negative pressure in the unsaturated soil, which enhances contaminant mobility. From the extraction wellhead, the VOCs are routed to the treatment facility. Under current regulations, no off-gas treatment is required. However, off-gas treatment will occur until it is determined that off-gases are safe. The SVE discharge will be monitored during initial operations to determine whether filtration or dispersion of off-gases is necessary.

Regular monitoring of the enhanced SVE system will be conducted to ensure and document its effectiveness and optimize the progress of cleanup. Vapor samples and airflow readings taken from the soil vapor monitoring probes and system exhaust sampling ports will be utilized to monitor the progress of cleanup, to estimate the volume of VOCs removed by the system, and to establish a timetable and cost estimate for completion of the project.

Historically, SVE/AS remediation has been successful at remediating soil and groundwater to the state and federal MCLs within several months to two years, dependent on many conditions

including initial contaminant concentrations. Because of climatic conditions at Fort Wainwright, it is estimated that SVE/AS treatment would operate for three years to meet state and federal MCLs in the active treatment zone and 10 years in the remainder of the groundwater plume, which is located beyond the 20-ppb isocontour.

Remediation of VOC-contaminated soil and groundwater at the DRMO Yard source area by natural attenuation is expected to take more than 50 years.

The estimated present worth cost of this alternative would be approximately $2,195,000, which comprises $1,426,000 for capital costs, $680,000 for annual O&M costs, and $89,000 for annual groundwater monitoring. For costing purposes, it was assumed that a groundwater monitoring program would be implemented and that there would be one monitoring event per year (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). The estimated time frame for cleanup goals to be achieved and for monitoring to be performed is 15 years. These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

5.4.1.4 Alternative 4: Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and Disposal at the Fort Wainwright Landfill

This alternative supplements the remedial measures included under Alternative 3. One thousand nine hundred cubic yards of benzo(a)pyrene-contaminated surface soils would be excavated from the DRMO Yard and transported to the Fort Wainwright Landfill. Clean fill would replace the excavated material. Excavation and disposal of benzo(a)pyrene-contaminated soil would require one month. See DRMO Yard Alternative 3 above for a description of SVE/AS and groundwater monitoring. Soil contaminated with benzo(a)pyrene does not contribute to groundwater contamination and falls within the acceptable risk range for human health.

The estimated present worth cost of this alternative would be approximately $2,269,000, which comprises $1,498,000 for capital costs, $682,000 for annual O&M costs, and $89,000 for annual groundwater monitoring. For costing purposes, it was assumed that there would be one monitoring event per year (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). The estimated time frame for cleanup goals to be achieved and for monitoring to be performed is 15 years. These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

5.4.1.5 Alternative 5: Alternative 3 Plus Excavation and On-Site Solidification of Benzo(a)pyrene-Contaminated Soils

On-site solidification involves encapsulating benzo(a)pyrene-contaminated soils in concrete. Benzo(a)pyrene-contaminated soil will be excavated, solidified using a Portland cement matrix slurry, and disposed of on site. Excavation and solidification of benzo(a)pyrene-contaminated soils would require three months. See DRMO Yard Alternative 3 above for a description of an SVE/AS system and groundwater monitoring.

The estimated present worth cost of this alternative would be approximately $2,892,000, which comprises $2,062,000 for capital costs, $698,000 for annual O&M costs, and $132,000 for annual groundwater monitoring. For costing purposes, one monitoring event per year was assumed (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). The estimated time frame for cleanup goals to be achieved and for monitoring to be performed is 15 years. These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

5.4.2 Building 1168 Leach Well

Preliminary remedial alternatives for the Building 1168 Leach Well source area are described below. Numerous assumptions had to be made to determine cleanup time frames. These include consistent contaminant concentrations in soil and groundwater, treatment efficiencies similar to the currently operating SVE/AS system, and consistent groundwater flow.

5.4.2.1 Alternative 1: No Action

The no-action alternative for the Building 1168 Leach Well source area involves no environmental monitoring, institutional controls, or remedial action and would leave the VOC-contaminated soil and groundwater and petroleum-contaminated soils in their present state. Operation of the existing pilot-scale treatability system would be discontinued. The contaminated soils will continue to be subjected to infiltration and vertical seepage, which would cause further contamination of the groundwater. The groundwater plume will continue to migrate in the direction of groundwater flow. Development of the no-action alternative is required by the NCP to provide a basis of comparison for the remaining alternatives, serving as a baseline reflecting current conditions without any cleanup effort. The no-action alternative was evaluated consistent with NCP requirements. No present worth capital, O&M, or groundwater monitoring costs are associated with this no-action alternative.

5.4.2.2 Alternative 2: Institutional Controls and Natural Attenuation

Institutional controls for the Building 1168 Leach Well source area will include well installation restrictions, land use and site access restrictions, and downgradient groundwater monitoring/evaluation that includes developing and implementing a long-term annual groundwater monitoring program for approximately four wells (two existing and two new wells) for 30 years. Operation of the existing pilot-scale treatability study system would be discontinued. Land use restrictions include limiting future use of the land to operations being conducted at the Building 1168 Leach Well. The VOC-contaminated groundwater would remain as it exists at this source area, thereby not reducing contaminant concentrations other than through natural attenuation. However, institutional controls would decrease or minimize human exposure to contaminants. Periodic inspections and maintenance of the institutional controls would be conducted. Groundwater use restrictions would be incorporated into the Fort Wainwright Comprehensive Master Plan.

Natural attenuation or breakdown of contaminants occurs over time and is the reduction of contaminant concentrations in the environment through biological processes (aerobic and anaerobic biodegradation, and plant and animal uptake), physical phenomena (advection,

dispersion, dilution, diffusion, volatilization, and sorption/desorption), and chemical reactions (ion exchange, complexation, and abiotic transformation). Remediation of VOC-contaminated soil and groundwater at the Building 1168 Leach Well source area by natural attenuation is expected to take more than 50 years.

Environmental monitoring and data evaluation would be performed to obtain information regarding the effectiveness of the natural attenuation process in remediating the contamination, as well as to track the extent of contaminant migration from the site. To the extent practicable, this monitoring and evaluation would be conducted using four wells that are screened in geological zones hydraulically connected with the contamination source, supplemented by installing two additional groundwater monitoring wells if required. Upgradient wells would be used to provide information about the background groundwater quality at a source. Downgradient wells are used to monitor the extent of contaminant migration, change in flow direction, or occurrence of degradation products to protect downgradient drinking water wells.

Monitoring requirements would target VOCs, including contaminants that were found to exceed the state and federal MCLs or their potential degradation products, as specified in the RAOs for the Building 1168 Leach Well source area. Sample collection, analysis, and data evaluation would continue until sufficient data regarding changes in contaminant plume migration (including potential seasonal fluctuations in groundwater contaminant concentrations) and attenuation rates are gathered. The frequency of monitoring would be defined during the post-ROD activities.

The estimated present worth cost of this alternative is $130,000, which comprises $49,000 for capital costs and $81,000 for annual groundwater monitoring, based on an estimated 30-year time frame for groundwater monitoring for cost estimating purposes (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation and flow direction). However, monitoring would occur until state and federal MCLs are achieved, which would be more than 30 years.

These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

5.4.2.3 Alternative 3: Soil Vapor Extraction, Groundwater Air Sparging, and Monitoring

A pilot-scale treatability system is operating at the source area to test the effectiveness of the technologies included in this alternative. This alternative would upgrade the existing system to a full-scale system. The saturated zone active treatment area would be expanded by a factor of six to cover the entire contaminated saturated zone. System modifications would include installation of approximately four additional sparge points and one additional SVE point, increasing the capacity of sparging, extraction, and control equipment. System modification also would require installation of an additional blower to compensate for the increased head losses of the additional wells and piping.

Air will be injected below the water table to strip volatiles from groundwater and soil in the saturated and unsaturated zones, respectively. Volatiles are purged to the unsaturated zone,

where they will be collected in the vacuum extraction wells. In addition, the vacuum extraction wells create a negative pressure in the unsaturated soil, which enhances contaminant mobility. From the extraction wellhead, the VOCs are routed to the treatment facility. Under current regulations, no off-gas treatment is required. However, off-gases were treated initially through a carbon adsorption system. Use of the treatment system was discontinued because air modeling using a worst-case scenario indicated that treatment was unnecessary. This system can be restarted if analytical results indicate that off-gas treatment is necessary.

Regular monitoring of the enhanced SVE system will be conducted to ensure and document its effectiveness and optimize the progress of cleanup. Vapor samples and airflow readings taken from the soil vapor monitoring probes and system exhaust sampling ports will be utilized to monitor the progress of cleanup, to estimate the volume of VOCs removed by the system, and to establish a timetable and cost estimate for completion of the project.

Historically, SVE/AS remediation has been successful at remediating soil and groundwater to state and federal MCLs within several months to two years, depending on many conditions including initial contaminant concentrations. Based on the operational data acquired since the start of the pilot-scale treatment system in 1994, it is estimated that SVE/AS treatment would operate an additional three years to meet state and federal MCLs in the active treatment zone. State and federal MCL exceedances outside the active treatment zone are anticipated to attenuate naturally, partially in response to the increased downgradient dissolved oxygen availability associated with the active treatment system.

Monitoring requirements will target the contaminants that were found to exceed the state and federal MCLs as specified in the RAOs for the Building 1168 Leach Well source area. Sample collection, analysis, and data evaluation would continue until sufficient data regarding changes in contaminant plume migration (including potential seasonal fluctuations in groundwater contaminant concentrations) and attenuation rates are gathered. To the extent practicable, monitoring data requirements will be coordinated or combined with those from other state or federal programs, such as RCRA and the Safe Drinking Water Act. The frequency of monitoring would be defined specifically in post-ROD documents.

This alternative would achieve remediation goals in approximately three years. Groundwater monitoring would be conducted 10 years. For costing purposes, one well would be installed for the SVE system and four wells would be installed for the AS system for an operational period of three years. The estimated present worth cost of this alternative would be approximately $269,000, which comprises $174,000 for capital, $66,000 for annual O&M costs, and $29,000 for annual groundwater monitoring (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

5.4.2.4 Alternative 4: Alternative 3 Plus Excavation and Low-Temperature Thermal Desorption of Contaminated Unsaturated Soil

This alternative is similar to Alternative 3, except that approximately 1,400 cubic yards of soil contaminated with DRO; GRO; and benzene, toluene, ethylbenzene, and total xylenes will be excavated and treated using a low-temperature thermal desorption (LTTD) process. This

alternative would be implemented only if SVE/AS could not reduce contaminant concentrations in the unsaturated zone to below RAOs. LTTD involves heating excavated soils in a rotary kiln dryer to release organic contaminants and moisture in the form of gases. The gases go through a series of cooling and condensing stages before they are vented.

Excavation would be conducted to an estimated depth of 19 feet below present grade, which would require shoring. Approximately 4,400 cubic yards of uncontaminated overburden material would need to be removed. Clean soil would replace the 1,300 cubic yards of excavated soil. The treated soil would be disposed of at the Fort Wainwright Landfill.

See Alternative 3 above for descriptions of SVE and groundwater AS and for a description of groundwater monitoring.

Excavation and LTTD treatment would require one month. The estimated present worth cost of this alternative would be approximately $559,000, which comprises $452,000 for capital, $78,000 for annual O&M costs, and $29,000 for annual groundwater monitoring (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

5.4.2.5 Alternative 5: Alternative 3 Plus Excavation and Engineered Pile Treatment (Biopile and Vapor Extraction Pile) of Contaminated Unsaturated Soil

This alternative is similar to Alternative 3, except that excavated soil is treated using engineered pile treatment at a nearby location. There are two options for the engineered pile treatment of the contaminated unsaturated soil: a vapor extraction pile and a biopile. Both options are ex situ remedies and would require excavation, as described in Building 1168 Leach Well Alternative 4. A vapor extraction pile uses the same processes as in situ vapor extraction, but the processes are applied to a pile in a lined cell. Blowers built into a piping system inject and extract air to strip off VOCs and petroleum hydrocarbons from the soil. Biopile or biocell treatment is a process that uses naturally occurring bacteria in soil to break down VOCs and petroleum hydrocarbons. The excavated soil is placed in lined piles and is aerated using an air injection system.

See Alternative 3 above for descriptions of SVE and groundwater AS and for a description of groundwater monitoring and evaluation requirements.

The estimated time frame for cleanup goals to be achieved is three years. The estimated present worth cost of this alternative would be $498,000, which comprises $350,000 for capital costs, $119,000 for annual O&M costs, and $29,000 for annual groundwater monitoring (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

Table 5-1

SELECTION OF CHEMICALS OF CONCERN FOR REMEDIAL EVALUATION IN THE FEASIBILITY STUDY FOR DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

Chemicals of Potential Concern to the FS	Basis for Discarding or Retaining as Chemical of Concern to the FS
The following contaminants were found in soils and were discarded or carried through the FS as contaminants of concern for remedial evaluation. This is based on the following reasons:	
Soil	
Benzo(a)pyrene	Retain: Concentrations are within the 10^{-4} to 10^{-6} risk range. Benzo(a)pyrene was found in surface soils and is not considered a threat to groundwater.
PCBs	Discard: The maximum concentration of PCBs detected in soil at the DRMO Yard source area is 1.3 mg/kg, significantly less than the Toxic Substances Control Act (TSCA 1987) most restrictive cleanup level of 10 mg/kg.
Dioxin	Discard: Concentrations do not cause exceedance of 10^{-4} cancer risk for site worker, future site worker, future residents, future construction workers, and future recreational users/site visitors. In addition, dioxin is ubiquitous throughout the DRMO Yard source area, at very low concentrations. Analytical results do not indicate that a dioxin "hot spot" exists.
DRO	Discard: DRO in the DRMO Yard soils is attributed to surface spills and UST releases and will be addressed in a separate Two-Party Agreement between the Army and ADEC.
GRO	Discard: GRO in the DRMO Yard soils is attributed to surface spills and UST releases and will be addressed in a separate Two-Party Agreement between the Army and ADEC.
Dieldrin	Discard: The HRA concluded that cancer risk presented by dieldrin exceeded 10^{-6} for two exposure pathways (current/future worker RME dermal contact with surface soil and future resident RME dermal contact with surface soil). However, resampling of surface soil in August 1995 in five locations around the only sampling location where dieldrin was previously detected indicates that dieldrin concentrations are not detectable or are two to three orders of magnitude below 1 mg/kg (1 mg/kg corresponds to a 10^{-4} cancer risk to future residents). Dieldrin was detected in six of 314 samples.
Arsenic	Discard: Concentrations cause exceedance of 10^{-6} cancer risk for two exposure pathways (current/future worker RME and future resident RME and average exposure ingestion of surface soil) but was not considered a COC because of documented elevated concentrations of arsenic in background surface soil samples. Recalculation of risks after subtracting background concentrations results in a cancer risk of less than 10^{-6}.

Key at end of table.

Table 5-1

SELECTION OF CHEMICALS OF CONCERN FOR REMEDIAL EVALUATION IN THE FEASIBILITY STUDY FOR DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

Chemicals of Potential Concern to the FS	Basis for Discarding or Retaining as Chemical of Concern to the FS
The following contaminants were found in groundwater and were discarded or carried through the FS as contaminants of concern for remedial evaluation. This is based on the following reasons:	
Groundwater	
Benzene	Retain: Concentrations cause exceedance of MCL.
Trichloroethene	Retain: Concentrations measured in excess of MCL.
Tetrachloroethene	Retain: Concentrations cause exceedance of MCL.
Manganese	Discard: Concentrations cause exceedance of hazard index of 1.0 for one exposure pathway (future resident RME ingestion) but was not considered a COC because of documented elevated concentrations of manganese in background groundwater samples. Recalculation of risks after subtracting background concentrations results in a hazard index of less than 1.0 for the entire DRMO Yard.
Chloroform	Discard: Concentrations cause slight exceedance of 10^{-6} cancer risk for one exposure pathway (future resident RME inhalation) but was not considered a COC because concentrations did not exceed MCL.
Dioxin	Discard: Concentrations cause exceedance of 10^{-6} cancer risk for one exposure pathway (future resident RME ingestion) but was not considered a COC because concentrations did not exceed MCL.
1,4-Dichlorobenzene	Discard: Concentrations cause exceedance of 10^{-6} cancer risk for one exposure pathway (future resident RME ingestion) but was not considered a COC because concentrations did not exceed MCL.

Note: Breakdown products of the contaminants of concern were not in concentrations that exceeded action levels; however, these will be included in groundwater monitoring.

Key:

ADEC = Alaska Department of Environmental Conservation.
Army = United States Army.
COC = Chemical of concern.
DRMO = Defense Reutilization and Marketing Office.
DRO = Diesel-range organics.
FS = Feasibility Study.
GRO = Gasoline-range organics.
HRA = Human Health Risk Assessment.
MCL = Maximum contaminant level.
mg/kg = Milligrams per kilogram.
PCBs = Polychlorinated biphenyls.
RME = Reasonable maximum exposure.
TSCA = Toxic Substances Control Act.
UST = Underground storage tank.

Table 5-2

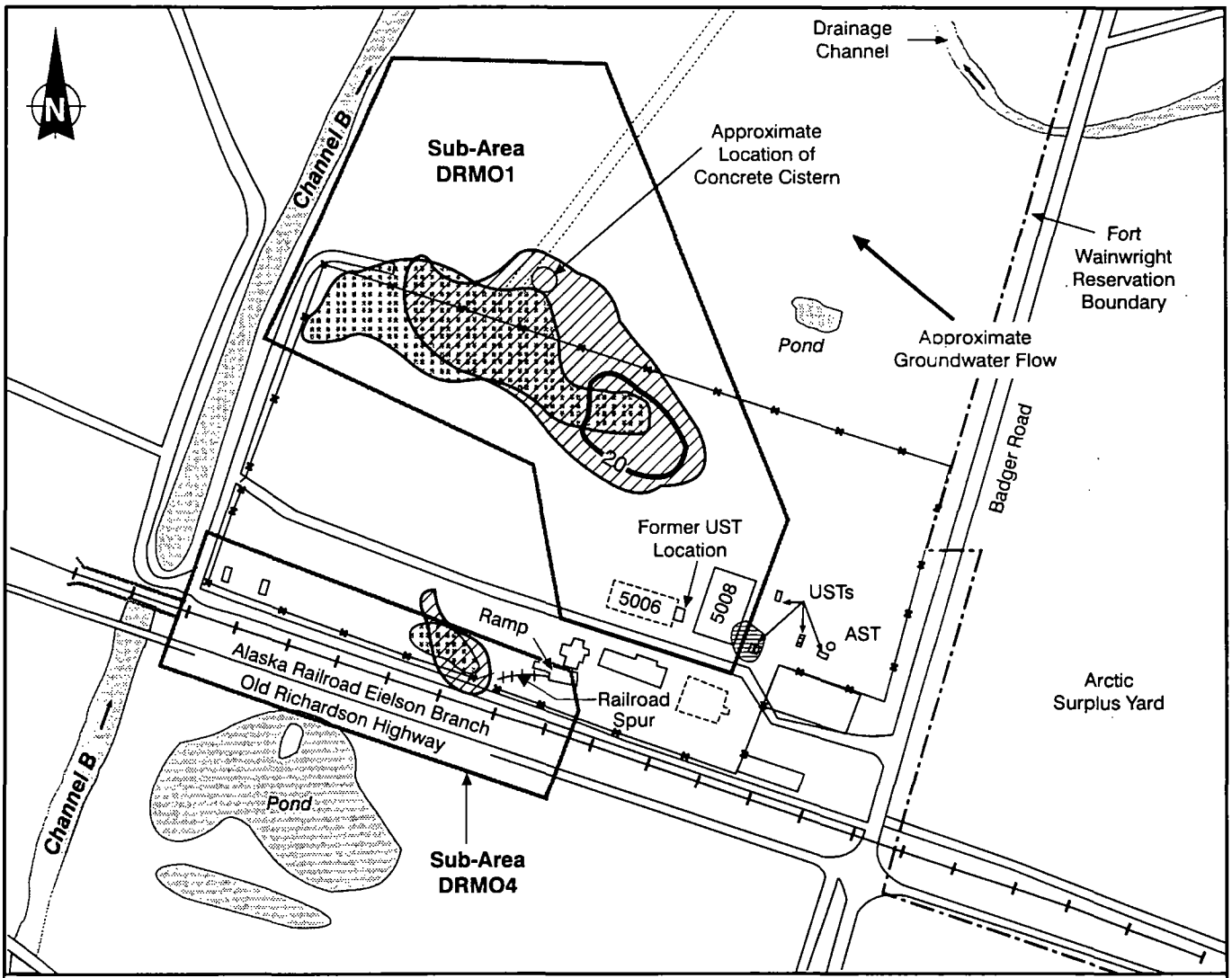
SELECTION OF CHEMICALS OF CONCERN TO THE FEASIBILITY STUDY FOR BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

Chemicals of Potential Concern	Discard or Retain as Chemical of Concern to the FS and Bases
Soil	
DRO	Retain: Concentrations exceed ADEC guidelines.
GRO	Retain: Concentrations exceed ADEC guidelines.
BTEX	Retain: Concentrations exceed ADEC guidelines.
Groundwater	
Benzene	Retain: Concentrations cause exceedance of MCL.
Trichloroethene	Retain: Concentrations cause exceedance of MCL.
Manganese	Discard: Concentrations cause exceedance of hazard index of 1.0 for one exposure pathway (future resident RME and average ingestion) but was not considered a COC because of documented elevated concentrations of manganese in background groundwater samples. Recalculation of risks after subtracting background concentrations of manganese and arsenic results in a hazard index of less than 1.0.
Arsenic	Discard: Concentrations cause exceedance of hazard index of 1.0 for one exposure pathway (future resident RME and average ingestion). Arsenic concentrations also cause exceedance of 10^{-6} cancer risk for one exposure pathway (future resident RME and average ingestion). However, arsenic is not considered a COC because of documented elevated concentrations of arsenic in background groundwater samples. Recalculation of risks after subtracting background concentrations of manganese and arsenic results in a hazard index of less than 1.0. Background arsenic concentrations still contribute to cancer risk in excess of 10^{-6}.

Note: Breakdown products of the contaminants of concern were not in concentrations that exceeded action levels; however, these will be included in groundwater monitoring.

Key:

ADEC = Alaska Department of Environmental Conservation.
BTEX = Benzene, toluene, ethylbenzene, and total xylenes.
COC = Chemical of concern.
DRO = Diesel-range organics.
FS = Feasibility Study.
GRO = Gasoline-range organics.
MCL = Maximum contaminant level.
RME = Reasonable maximum exposure.



KEY:

- Fence
- Former Building Location
- AST Aboveground Storage Tank
- 20 PCE Isoconcentration contour in micrograms per liter
- UST Underground Storage Tank
- Benzene in groundwater
- Tetrachloroethene in groundwater
- Trichloroethene in groundwater

SCALE (Feet)

0 300 600

Figure 5-1
AERIAL EXTENT OF PROPOSED ACTIVE TREATMENT ALTERNATIVE 3
DRMO YARD SOURCE AREA
OPERABLE UNIT 2

FAIRBANKS ALASKA

SIZE	JOB NO.	FILE NO.	DATE	PLATE
B	JT2901	JT2674_8.CDR	96MAY28	

6.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

In accordance with federal regulations, the five alternatives for the DRMO Yard source area and five other alternatives for the Building 1168 Leach Well source area were evaluated based on the nine criteria presented in the NCP.

6.1 DEFENSE REUTILIZATION AND MARKETING OFFICE YARD SOURCE AREA (COMPARATIVE ANALYSIS OF ALTERNATIVES)

6.1.1 Threshold Criteria

6.1.1.1 Overall Protection of Human Health and the Environment

Alternatives 3, 4, and 5 would provide the greatest protection to human health and the environment by actively treating contaminated soil and groundwater. Alternatives 1 and 2 would rely on natural processes to slowly decrease contaminant concentrations in the soil and groundwater. Alternatives 1 and 2 would provide no treatment and would not be protective of human health or the environment.

6.1.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 2, 3, 4, and 5 are expected to achieve regulatory requirements. Alternatives 3, 4, and 5 include active soil and groundwater treatment to achieve state and federal MCLs and would be expected to achieve these standards more rapidly than Alternative 2. Alternative 2 would rely on natural processes that slowly decrease soil and groundwater contamination. Alternative 1 would not comply with ARARs. AWQS would be achieved through natural attenuation under all of the alternatives.

6.1.2 Main Balancing Criteria

6.1.2.1 Long-Term Effectiveness and Permanence

Alternatives 3, 4, and 5 would involve permanent and active reduction of soil and groundwater contamination and would achieve long-term effectiveness. Alternatives 4 and 5 would permanently remove the benzo(a)pyrene-contaminated soil. None of the contaminants would be addressed by Alternatives 1 and 2, except through natural processes. Therefore, Alternatives 1 and 2 would provide the least effective long-term permanence.

6.1.2.2 Reduction of Toxicity, Mobility, and Volume Through Treatment

Alternatives 3, 4, and 5 would involve treatment technologies that reduce the toxicity and mobility of VOC-contaminated soil and groundwater. Alternative 4 would slightly increase the volume of contaminated soil and would not decrease toxicity or mobility of benzo(a)pyrene. Alternative 5 would reduce the mobility and significantly increase the volume of contaminated material. Alternatives 1 and 2 would not reduce the toxicity, mobility, or volume of the contaminants through treatment.

6.1.2.3 Short-Term Effectiveness

Alternatives 3, 4, and 5 would pose some short-term potential risks to on-site workers during the estimated three months for groundwater treatment installation and soil excavation (Alternatives 4 and 5). These risks could be minimized by engineering controls. These alternatives may take up to 10 years to achieve state and federal MCLs. The excavation and disposal in Alternative 4 would require one month. Solidification (Alternative 5) would require approximately three months.

Risks associated with groundwater contamination are equal for Alternatives 3, 4, and 5. Because Alternatives 3, 4, and 5 actively treat soil and groundwater contamination, it is expected that contaminant levels would be reduced during the estimated three-year cleanup period. Alternatives 1 and 2 do not actively treat soil contamination; therefore, risks would not change over time except through natural attenuation. Under Alternative 1, no monitoring would be conducted to determine the groundwater remediation time frame. However, it is expected that the time frame to reach remedial goals will be similar to Alternative 2—natural attenuation with groundwater monitoring—which is estimated to exceed 50 years.

Risks associated with groundwater contamination are equal for Alternatives 3, 4, and 5. Because Alternatives 3, 4, and 5 actively treat soil contamination, it is expected that groundwater contaminant levels would be reduced during the estimated three-year cleanup period. Alternatives 1 and 2 do not actively treat soil contamination; therefore, risks would not change over time, except through natural attenuation.

6.1.2.4 Implementability

All alternatives would use readily available technologies and would be feasible to construct. Alternatives 1 and 2 would be readily implementable because they would require no additional action other than monitoring or institutional controls. A pilot-scale test study or field test would be conducted before full-scale implementation of the SVE and AS systems proposed in Alternatives 3, 4, and 5. A solidification treatability study would be required before implementing Alternative 5.

6.1.2.5 Cost

The estimated present worth cost for each alternative evaluated for the DRMO Yard source area is shown in Table 6-1. Detailed baseline cost estimates are included in Appendix D.

Based on the information available at the time the alternatives were developed, the estimated costs for each alternative evaluated for the DRMO source area are in Table 6-1. Actual costs are likely to be within +50% to -30% of the values on the table. Present worth is based on a 5% discount rate over 30 years.

6.1.3 Modifying Criteria

6.1.3.1 State Acceptance

ADEC has been involved with the development of remedial alternatives for OU-2 and agrees

with the selected alternative for the DRMO Yard source area.

6.1.3.2 Community Acceptance

Although no official comments were received, community response to the preferred alternatives was generally positive. Community response to the remedial alternatives is presented in the Responsiveness Summary, which addresses comments received during the public comment period.

6.2 BUILDING 1168 LEACH WELL (COMPARATIVE ANALYSIS OF ALTERNATIVES)

6.2.1 Threshold Criteria

6.2.1.1 Overall Protection of Human Health and the Environment

Alternatives 3, 4, and 5 would provide the greatest protection to human health and the environment by actively treating contaminated soil and groundwater. Alternatives 1 and 2 would provide no treatment and would not be protective of human health or the environment.

6.2.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 2, 3, 4, and 5 are expected to achieve regulatory requirements. Alternatives 3, 4, and 5 include active groundwater treatment to achieve state and federal MCLs and would be expected to achieve these standards more rapidly than Alternative 2. Alternative 2 would rely on natural processes that slowly decrease soil and groundwater contamination. Alternative 1 would not comply with ARARs. AWQS would be achieved through natural attenuation under Alternatives 3, 4, and 5.

6.2.2 Balancing Criteria

6.2.2.1 Long-Term Effectiveness and Permanence

Alternatives 3, 4, and 5 would involve permanent and active reduction of soil and groundwater contamination and would achieve long-term effectiveness. Alternatives 4 and 5 would permanently remove the VOC-contaminated soil by excavation and treatment. None of the contaminants would be addressed by Alternatives 1 and 2, except through natural processes. Therefore, Alternatives 1 and 2 would provide the least effective long-term permanence.

6.2.2.2 Reduction of Toxicity, Mobility, and Volume Through Treatment

Alternatives 3, 4, and 5 would involve treatment technologies that would reduce the toxicity and mobility of contaminants in soil and groundwater. Alternatives 4 and 5 would reduce the volume of the contaminated soil by excavation and treatment. Alternatives 1 and 2 would not reduce the toxicity, mobility, or volume of the contaminants through treatment.

6.2.2.3 Short-Term Effectiveness

Alternatives 3, 4, and 5 would pose some short-term potential risks to on-site workers during the estimated three months for groundwater treatment installation and soil excavation (Alternatives 4 and 5). These risks could be minimized by engineering controls. These alternatives may take up to three years to achieve groundwater cleanup to state and federal MCLs. The excavation and LTTD portion of Alternative 4 would be expected to require one field season. The engineered pile treatment portion of Alternative 5 would require five years.

Risks associated with groundwater contamination are equal for Alternatives 3, 4, and 5. Because Alternatives 3, 4, and 5 actively treat soil and groundwater contamination, it is expected that contaminant levels would be reduced during the estimated three-year cleanup period. Under Alternative 1, no monitoring would be conducted to determine the groundwater remediation time frame. However, it is expected that the time frame for remediation will be similar to Alternative 2—natural attenuation with groundwater monitoring—which is estimated to exceed 50 years. Alternatives 1 and 2 do not actively treat soil contamination; therefore, risks would not change over time except through natural attenuation.

6.2.2.4 Implementability

All alternatives would use readily available technologies and would be feasible to construct. The SVE and AS system pilot study is being conducted at the Building 1168 Leach Well, and results to date indicate that the system is effectively remediating the groundwater contamination. Alternatives 3, 4, and 5 propose expansion of this system for full-scale treatment. LTTD and engineered pile treatability studies would be required before implementing Alternatives 4 and 5, respectively.

6.2.2.5 Cost

The estimated present worth cost for each alternative evaluated for the Building 1168 Leach Well source area is shown in Table 6-2. Detailed cost tables are in Appendix D.

6.2.3 Modifying Criteria

6.2.3.1 State Acceptance

ADEC has been involved with the development of remedial alternatives for OU-2 and agrees with the selected alternative for the Building 1168 Leach Well source area.

6.2.3.2 Community Acceptance

Although no official comments were received, the community response to the preferred alternatives was generally positive. Community response to the remedial alternatives is presented in the Responsiveness Summary, which addresses comments received during the public comment period.

Table 6-1

PRESENT WORTH COSTS FOR REMEDIAL ALTERNATIVES
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA

Description	Capital Cost	Annual Operation and Maintenance Cost	Annual Groundwater Monitoring Cost	Total Present Worth Cost	Present Worth of Annual Cost
Alternative 1: No Action	$0	$0	$0	$0	$0
Alternative 2: Institutional Controls, Natural Attenuation, and Groundwater Monitoring/Evaluation	$34,000	$0	$146,000	$180,000	$146,000
Alternative 3: Soil Vapor Extraction, Groundwater Air Sparging, Natural Attenuation, and Groundwater Monitoring/Evaluation	$1,426,000	$680,000	$89,000	$2,195,000	$769,000
Alternative 4: Alternative 3 Plus Excavation and Disposal of Surface Soils Containing Benzo(a)pyrene	$1,498,000	$682,000	$89,000	$2,269,000	$771,000
Alternative 5: Alternative 3 Plus Excavation and On-Site Solidification of Soils Containing Benzo(a)pyrene	$2,062,000	$698,000	$132,000	$2,892,000	$830,000

Key:

DRMO = Defense Reutilization and Marketing Office.

Table 6-2

PRESENT WORTH COSTS FOR REMEDIAL ALTERNATIVES
BUILDING 1168 LEACH WELL SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA

Description	Capital Cost	Annual Operation and Maintenance Cost	Annual Groundwater Monitoring Cost	Total Present Worth Cost	Present Worth of Annual Cost
Alternative 1: No Action	$0	$0	$0	$0	$0
Alternative 2: Institutional Controls and Natural Attenuation with Groundwater Monitoring/Evaluation	$49,000	$0	$81,000	$130,000	$81,000
Alternative 3: Soil Vapor Extraction, Groundwater Air Sparging with Natural Attenuation, and Groundwater Monitoring/Evaluation	$174,000	$66,000	$29,000	$269,000	$95,000
Alternative 4: Alternative 3 Plus Excavation and Low-Temperature Thermal Desorption of Unsaturated Soil	$452,000	$78,000	$29,000	$559,000	$107,000
Alternative 5: Alternative 3 Plus Engineered Pile Treatment of Unsaturated Soil	$350,000	$119,000	$29,000	$498,000	$148,000

7.0 SELECTED REMEDIES

7.1 DEFENSE REUTILIZATION AND MARKETING OFFICE YARD

Because it best meets the nine CERCLA criteria, Alternative 3 is the selected remedy for groundwater contamination for the DRMO Yard source area. This alternative involves in-place treatment of soils via vacuum extraction; in-place, on-site treatment of groundwater via air sparging; groundwater monitoring/evaluation; and institutional controls. Alternative 3 is expected to achieve overall protection of human health and the environment and to meet ARARs through active treatment of soil and groundwater (see Table 7-1). This alternative protects the on-site potable drinking water well as well as the downgradient drinking water aquifer by treating and controlling the source of contamination and is viewed as being an effective and permanent solution to contamination at the DRMO Yard.

After a thorough assessment of the applicable alternatives for the DRMO Yard source area, taking groundwater risks, cleanup times, and cost into consideration, it was determined that protection of human health and the environment is best attained through active in-place treatment of soils and groundwater. After evaluation of the potential risks and appropriate cleanup standards and comparison with the nine CERCLA criteria, it was determined that action is not required for benzo(a)pyrene in soils. This alternative is believed to provide the best balance of criteria among the alternatives evaluated.

7.1.1 Major Components of the Selected Remedy

- In situ treatment of groundwater and soil via air sparging to attain state and federal drinking water standards. Air sparging wells will be placed in the areas of highest contamination;

- In situ treatment of soils via soil vapor extraction to prevent contaminated unsaturated soils from acting as an ongoing source of contamination to groundwater. Soil vapor extraction wells will be placed in areas of highest soil contamination;

- Air emissions from the soil vapor extraction/air sparging treatment system will be monitored and evaluated periodically to meet emission requirements;

- The treatment system will be evaluated and modified as necessary to optimize effectiveness;

- Duration of treatment system operation is estimated to be three years in the active treatment zone and nine years at the Channel B wells to meet soil cleanup goals and state and federal maximum contaminant levels. A combination of groundwater monitoring and off-gas measurements will be used to determine attainment of remedial action objectives;

- After active treatment achieves state and federal maximum contaminant levels, natural attenuation will be relied on to achieve Alaska Water Quality Standards;

- Maintaining institutional controls, including restricted access and well development restrictions, and a groundwater monitoring and evaluation program for the potable drinking water supply wells. These controls will remain in place as long as hazardous substances remain on site at levels that preclude unrestricted use; and

- Additional institutional controls to prohibit refilling the DRMO Yard fire suppression water tank from the existing DRMO Yard potable water supply well until state and federal maximum contaminant levels are met (except in emergency situations).

7.1.2 Goals of Remedial Action

The overall goal of a remedial action is to provide the most effective mechanism to meet state and federal regulations for drinking water. To facilitate selection of the most appropriate remedial action, source area-specific cleanup objectives that specify the contaminants of concern in each medium of interest, exposure pathways and receptors, and an acceptable regulatory level were developed. The following remediation goals were established for the specific contaminants of concern determined to require remedial action at both source areas. These goals are intended for the areas where active remediation will occur.

7.1.2.1 Defense Reutilization and Marketing Office Yard Groundwater and Soil

CHEMICALS OF CONCERN IN GROUNDWATER	REMEDIATION GOAL (μg/L)[a]
Benzene	5.0
Trichloroethene	5.0
Tetrachloroethene	5.0
Vinyl chloride	2.0
1,1-Dichloroethene	7.0
1,2-Dichloroethene	70.0

a Groundwater remediation goals are based on federal and state MCLs for organic contaminants in public water supply systems (40 Code of Federal Regulations [CFR] 141.147 and 18 AAC 80).

At the DRMO Yard, after state and federal MCLs are achieved through active remediation, passive treatment of groundwater through natural attenuation will be relied on to attain AWQS (18 AAC 70).

Because soils contaminated with VOCs and petroleum-related compounds are acting as a continuing source of contamination to groundwater, the remedial action goal for in situ soils is active remediation until contaminant levels in groundwater are consistently below state and federal MCLs. The State of Alaska cleanup levels for UST petroleum-contaminated soil will be considered as a guideline for the treatment of in situ soils (see Table 7-2).

The cost for Alternative 3 is $1,498,000 for present worth capital costs, which include direct and indirect cost; annual monitoring for 15 years (monitoring frequency may vary) at $89,000; and present worth of annual operating cost $680,000, for a total cost of $2,195,000.

The remedial action goal for in situ soils contaminated with comingled VOC- and petroleum related-compounds is protection of the groundwater. Because the soils are acting as a continuing source of contamination to the groundwater, active remediation of the soils will continue until state and federal MCLs are met consistently. Natural attenuation will continue until AWQS are met. Some changes or modifications could be made to the remedy as a result of Remedial Design and construction processes. These changes will be addressed in post-ROD documents.

The goal of this remedial action is to restore groundwater to its beneficial use, which is a drinking water aquifer. Based on information obtained during the RI and on careful analysis of all remedial alternatives, the Army, EPA, and ADEC believe that the selected remedy would achieve this goal.

7.2 BUILDING 1168 LEACH WELL

Alternative 3 is the preferred alternative for the Building 1168 Leach Well source area because it best meets the nine CERCLA criteria summarized in Table 7-3. This alternative involves in place treatment of soils and groundwater via soil vapor extraction/air sparging, groundwater monitoring, and institutional controls. Alternative 3 is expected to achieve overall protection of human health and the environment and to meet ARARs (see Table 7-4). In addition, this alternative is viewed as being an effective and permanent solution to contamination at the Building 1168 Leach Well.

After a thorough assessment of the applicable alternatives for the Building 1168 Leach Well source area, taking groundwater risks, cleanup times, and cost into consideration, it was determined that protection of human health and the environment is best attained through active in-place treatment of soils and groundwater. This alternative is believed to provide the best balance of criteria among the alternatives evaluated.

7.2.1 Major Components of the Selected Remedy

- In situ treatment of groundwater via air sparging to remove volatile organic compounds, thereby attaining state and federal drinking water standards. Additional air sparging wells will be placed to optimize the existing treatment system;

- In situ treatment of soils via soil vapor extraction to prevent contaminated soils from acting as an ongoing source of contamination to

groundwater. Additional soil vapor extraction wells will be placed to optimize the existing treatment system;

- The treatment system will be evaluated and modified as necessary to optimize effectiveness;
- Air emissions from the soil vapor extraction/air sparging treatment system will be monitored and evaluated periodically to meet emission requirements;
- The duration of treatment system operation is estimated to be three years to meet State of Alaska cleanup levels for non-underground storage tank petroleum-contaminated soil and state and federal MCLs. A combination of groundwater monitoring and off-gas measurements will be used to determine attainment of remedial action objectives;
- After active treatment achieves state and federal maximum contaminant levels, natural attenuation will be relied on to achieve Alaska Water Quality Standards; and
- Maintaining institutional controls, including restricted access and well development restrictions, as long as hazardous substances remain on site at levels that preclude unrestricted use.

7.2.2 Goals of Remedial Action

The overall goal of a remedial action is to provide the most effective mechanism to meet state and federal MCLs for drinking water. To facilitate selection of the most appropriate remedial action, source area-specific cleanup objectives that specify the contaminants of concern in each medium of interest, exposure pathways and receptors, and an acceptable regulatory level were developed. The following remediation goals were established for the specific contaminants of concern determined to require remedial action at both source areas. These goals are intended for the areas where active remediation will occur.

7.2.3 Building 1168 Leach Well Groundwater and Soil

CHEMICALS OF CONCERN IN GROUNDWATER	REMEDIATION GOAL (μg/L)[a]
Benzene	5.0
Trichloroethene	5.0
Tetrachloroethene	5.0
Vinyl chloride	2.0
1,1-Dichloroethene	7.0
1,2-Dichloroethene	70.0

[a] Groundwater remediation goals are based on state and federal MCLs for organic contaminants in public water supply systems (40 CFR 141.147 and 18 AAC 80).

At the Building 1168 Leach Well, after state and federal MCLs are achieved through active remediation, passive treatment of groundwater through natural attenuation will be relied on to attain cleanup levels mandated by the AWQS (18 AAC 70).

Because soils contaminated with VOCs and petroleum-related compounds are acting as a continuing source of contamination to groundwater, the remedial action goal for in situ soils is active remediation until contaminant levels in groundwater are consistently below state and federal MCLs. The State of Alaska cleanup levels for non-UST petroleum-contaminated soil will be considered as a guideline for the treatment of in situ soils.

The cost for Alternative 3 is $174,000 for present worth capital costs, which include direct and indirect costs; annual monitoring for 15 years at $29,000 (monitoring frequency may vary); and a present worth of annual operating cost of $66,000, for a total cost of $269,000.

The remedial action goal for in situ soils contaminated with VOC and POL compounds is protection of the groundwater. Because the soils are acting as a continuing source of contamination to the groundwater, active remediation of the soils will continue until state and federal MCLs are met consistently. Natural attenuation will continue until AWQS are met. Some changes or modifications could be made to the remedy as a result of Remedial Design and construction processes. These changes will be addressed in post-ROD documents.

The goal of this remedial action is to restore groundwater to its beneficial use, which is, at this site, a potential drinking water aquifer, and to remediate soil to State of Alaska cleanup levels for non-UST petroleum-contaminated soil. Based on information obtained during the RI and on careful analysis of all remedial alternatives, the Army, EPA, and ADEC believe that the selected remedy would achieve this goal.

Because the remedies will result in contaminants remaining on site above health-based or regulatory levels, a review will be conducted within five years after commencement of remedial action. This review will ensure that the remedies continue to provide adequate protection of human health and the environment.

Table 7-1

DRMO YARD REMEDIAL ACTION OBJECTIVES AND REMEDIATION GOALS
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA

Remedial Action Objectives	Chemicals of Concern	Preliminary Remediation Goal	Basis	Maximum Measured Concentration
Environmental Protection	DRO	ADEC Cleanup Matrix[a]	ADEC 18 AAC 78	2,500 mg/kg
Prevent migration of chemicals of concern that could result in groundwater contamination exceeding chemical-specific ARARS. Restore groundwater to below chemical-specific ARARs.	Benzene	5 µg/L	MCL	7.50 g/L
	Tetrachloroethene	5 µg/L	MCL	190 µg/L
Human Heath	Trichloroethene	5 µg/L	MCL	17 µg/L
	Vinyl chloride	2 µg/L	Potential degradation	ND
Reduce cancer risk (via ingestion and inhalation by future residents) to within or below the 1×10^{-4} to 1×10^{-6} risk range.	1,1-DCE[b]	7 µg/L	Potential degradation	ND
	1,2-DCE[b]	70 µg/L	Potential degradation	ND

a ADEC soil matrix concentrations will be considered as a guidance for in situ treatment of soils.

b Breakdown products of trichloroethene were not detected at concentrations that exceeded action levels; however, these will be included in groundwater monitoring.

Key:

AAC = Alaska Administrative Code.
ADEC = Alaska Department of Environmental Conservation.
ARARs = Applicable or relevant and appropriate requirements.
DCE = Dichloroethene.
DRMO = Defense Reutilization and Marketing Office.
DRO = Diesel-range organics.
g/L = Grams per liter.
MCL = Maximum contaminant level.
mg/kg = Milligrams per kilogram.
µg/L = Micrograms per liter.
ND = Not detected.

Table 7-2

CHEMICAL-SPECIFIC CLEANUP GOALS FOR SOIL
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA

CLEANUP GOALS FOR SOIL					
DRMO YARD SCORE		**ADEC Cleanup Level (mg/kg)**			
		Diesel	**Gasoline/Unknown**		
Matrix Score = 44 BTEX = 15 mg/kg Benzene = 0.5 mg/kg VPH = 100 mg/kg EPH = 200 mg/kg		**Diesel-Range Petroleum Hydrocarbons (EPH)**	**Gasoline-Range Petroleum Hydrocarbons (VPH)**	**Benzene**	**BTEX**
Level A[e]	**>40**	**100**	**50**	**0.1**	**10**
Level B	27 - 40	200	100	0.5	15
Level C	21 - 26	1,000	500	0.5	50
Level D	<20	2,000	1,000	0.5	100

[a] Site-specific background groundwater concentration.
[b] Background concentrations from USAED Alaska-recommended background value for Fort Wainwright.
[c] Groundwater remedial goals are based on federal and state MCLs for organic contaminants in public water supply systems (40 CFR 141.147 and 18 AAC 80).
[d] 18 AAC 70, Water Quality Standards. The regulatory level for BTEX is 10 µg/L.
[e] Level A cleanup goal is applied to the total matrix score of 44 because of the soil acting as an ongoing source of contamination to groundwater.

Key:

AAC	=	Alaska Administrative Code.
ADEC	=	Alaska Department of Environmental Conservation.
BTEX	=	Benzene, toluene, ethylbenzene, xylene.
CFR	=	Code of Federal Regulations.
DRMO	=	Defense Reutilization and Marketing Office.
EPH	=	Diesel-range petroleum hydrocarbons.
MCLs	=	Maximum contaminant level.
µg/L	=	Micrograms per liter.
mg/kg	=	Milligram per kilogram.
USAED Alaska	=	United States Army Engineer District, Alaska.
VPH	=	Gasoline-range petroleum hydrocarbons.

Table 7-3

BUILDING 1168 LEACH WELL SOURCE AREA REMEDIAL ACTION OBJECTIVES AND REMEDIATION GOALS
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA

Media	Remedial Action Objectives	Chemicals of Concern	Preliminary Remediation Goal	Basis	Maximum Measured Concentration
Subsurface soil	Environmental Protection Prevent migration of chemicals of concern. Reduce chemical concentrations to below ADEC cleanup levels.	DRO	ADEC soil cleanup matrix[a]	ADEC 18 AAC 78	435 mg/kg
		GRO	ADEC soil cleanup matrix[a]	ADEC 18 AAC 78	2,000 mg/kg
		BTEX	ADEC soil cleanup matrix[a]	ADEC 18 AAC 78	Not available
Groundwater	Environmental Protection Restore groundwater to below chemical-specific ARARs.	Benzene	5 µg/L	MCL	250 µg/L[b]
		Trichloroethene	5 µg/L	MCL	23.0 g/L
	Human Health Reduce cancer risk (via ingestion and inhalation by future residents) to within or below the EPA accepted risk range of 1×10^{-4} to 1×10^{-6}.	Vinyl chloride	2 µg/L	Potential degradation product	ND
		1,1-DCE	7 µg/L	Potential degradation product	ND
		1,2-DCE	70 µg/L	Potential degradation product	ND

Note: Breakdown products of trichloroethene were not detected in concentrations that exceeded action levels; however, these will be included in groundwater monitoring.

a ADEC soil concentrations will be considered as a guidance for treatment of in situ soils.

b Maximum concentration of benzene was measured in a groundwater sample collected from Microwell installed by Pine and Swallow under direction from the United States Army's Cold Regions Research and Engineering Laboratory. The sample was collected and analyzed in September 1993 (HLA 1994).

Key at end of table.

Table 7-3 (Cont.)

Key:

AAC = Alaska Administrative Code.
ADEC = Alaska Department of Environmental Conservation.
ARARs = Applicable or relevant and appropriate requirements.
BTEX = Benzene, toluene, ethylbenzene, and total xylenes.
DCE = Dichloroethene.
DRO = Diesel-range organics.
EPA = United States Environmental Protection Agency.
GRO = Gasoline-range organics.
g/L = Grams per liter.
HLA = Harding Lawson Associates.
MCL = Maximum contaminant level.
µg/L = Micrograms per liter.
mg/kg = Milligrams per kilogram.
ND = Not detected.

Table 7-4

CHEMICAL-SPECIFIC CLEANUP GOALS FOR SOIL
BUILDING 1168 LEACH WELL SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA

CLEANUP GOALS FOR SOIL					
BUILDING 1168 LEACH WELL SOURCE AREA SCORE		ADEC Cleanup Level (mg/kg)			
		Diesel	Gasoline/Unknown		
Matrix Score = 46 BTEX = 15 mg/kg Benzene = 0.5 mg/kg VPH = 100 mg/kg EPH = 200 mg/kg		Diesel-Range Petroleum Hydrocarbons (EPH)	Gasoline-Range Petroleum Hydrocarbons (VPH)	Benzene	BTEX
Level A[e]	**>40**	**100**	**50**	**0.1**	**10**
Level B	27 - 40	200	100	0.5	15
Level C	21 - 26	1,000	500	0.5	50
Level D	<20	2,000	1,000	0.5	100

a Site-specific background groundwater concentration.

b Background concentrations from USAED Alaska-recommended background value for Fort Wainwright.

c Groundwater remedial goals are based on federal and state MCLs for organic contaminants in public water supply systems (40 CFR 141.147 and 18 AAC 80).

d 18 AAC 70, Water Quality Standards. The regulatory level for BTEX is 10 µg/L.

e Level A cleanup goal is applied to the total matrix score of 46 because of soil acting as an ongoing source of contamination to groundwater.

Key:

AAC	=	Alaska Administrative Code.
ADEC	=	Alaska Department of Environmental Conservation.
BTEX	=	Benzene, toluene, ethylbenzene, total xylene.
CFR	=	Code of Federal Regulations.
EPH	=	Diesel-range petroleum hydrocarbons.
MCLs	=	Maximum contaminant level.
µg/L	=	Micrograms per liter.
mg/kg	=	Milligrams per kilogram.
USAED Alaska	=	United Stated Army Engineer District, Alaska.
VPH	=	Gasoline-range petroleum hydrocarbons.

8.0 STATUTORY DETERMINATIONS

The main responsibility of the Army, EPA, and ADEC under their legal CERCLA authority is to select remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA, as amended by SARA, provides several statutory requirements and preferences. The selected remedy must be cost-effective and utilize permanent treatment technologies or resource recovery technologies to the extent practicable. The statute also contains a preference for remedies that permanently or significantly reduce the volume, toxicity, or mobility of hazardous substances through treatment. CERCLA finally requires that the selected remedial action for each source area must comply with ARARs established under federal and state environmental laws, unless a waiver is granted.

8.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected alternatives for the DRMO Yard and Building 1168 Leach Well source areas will provide long-term protection of human health and the environment and satisfy the requirements of Section 121 of CERCLA.

8.1.1 Defense Reutilization and Marketing Office Yard

The selected remedy will provide long-term protection of human health and the environment by removing the contamination from soils and groundwater through installation of an SVE/AS system. The remedy will eliminate the potential exposure routes and minimize the possibility of contamination migrating to drinking water sources. Groundwater monitoring/evaluation will be completed to assess contaminant plume movement and concentrations.

8.1.2 Building 1168 Leach Well

The selected remedy will provide long-term protection of human health and the environment by removing the contamination from soils and groundwater through installation of an SVE/AS system. The remedy will eliminate the potential exposure routes and minimize the possibility of contamination migrating to drinking water sources. Groundwater monitoring/evaluation will be completed to assess contaminant plume movement and concentrations.

8.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO-BE-CONSIDERED GUIDANCE

The selected remedy for each source area will comply with all applicable, relevant, and appropriate requirements of federal and state environmental and public health laws. These requirements include compliance with all the location-, chemical-, and action-specific ARARs listed below. No other waiver of any ARAR is being sought or invoked for any component of the selected remedies.

8.2.1 Applicable or Relevant and Appropriate Description

An ARAR may be either "applicable" or "relevant and appropriate." Applicable requirements are those substantive environmental protection standards, criteria, or limitations promulgated under federal or state law that specifically addresses a hazardous substance, remedial action,

location, or other circumstance at a CERCLA site. Relevant and appropriate requirements are those substantive environmental protection requirements promulgated under federal and state law that, while not legally applicable to the circumstances at a CERCLA site, addresses situations sufficiently similar to those encountered at the CERCLA site so that the requirements' use is well-suited to the particular site. The three types of ARARs are described below:

- Chemical-specific ARARs are usually health- or risk-based numerical values or methodologies that establish an acceptable amount or concentration of a chemical in the ambient environment;

- Action-specific ARARs are usually technology- or activity-based requirements for remedial actions; and

- Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activity solely because the ARARs occur in special locations.

To-be-considered requirements (TBCs) are nonpromulgated federal or state standards or guidance documents that are to be used as appropriate in developing cleanup standards. Because they are not promulgated or enforceable, TBCs do not have the same status as ARARs and are not considered required cleanup standards. They generally fall into three categories:

- Health effects information with a high degree of credibility;

- Technical information regarding how to perform or evaluate site investigations or response actions; and

- State or federal agency policy documents.

8.2.2 Chemical-Specific Applicable or Relevant and Appropriate Requirements

- Federal Safe Drinking Water Act (40 CFR 141) and Alaska Drinking Water Regulations (18 AAC 80): The MCL and non-zero MCL goals were established under the Safe Drinking Water Act and are relevant and appropriate for groundwater that is a potential drinking water source;

- AWQS (18 AAC 70): Alaska Water Quality Standards for Protection of Class (1)(A) Water Supply, Class (1)(B) Water Recreation, and Class (1) Aquatic Life and Wildlife (18 AAC 70) are applicable to both source areas. Many of the constituents of groundwater regulated by AWQS are identical to MCLs in Drinking Water Standards;

- Alaska Oil Pollution Regulations (18 AAC 75): Alaska Oil Pollution Control Regulations, are applicable. Under these regulations, responsible parties are required to clean up oil or hazardous material

releases. The Army anticipates achieving a cleanup level consistent with this regulation; and

- Alaska Regulations for Leaking Underground Storage Tanks (18 AAC 78): The State of Alaska has established cleanup requirements for petroleum-contaminated soils from leaking USTs to protect groundwater and are relevant and appropriate for the DRMO Yard.

8.2.3 Location-Specific Applicable or Relevant and Appropriate Requirements

No location-specific ARARs have been identified for the DRMO Yard and Building 1168 Leach Well source areas.

8.2.4 Action-Specific Applicable or Relevant and Appropriate Requirements

- RCRA Subtitle C Hazardous Waste Management Standards must be considered in the evaluation of whether any of the excavated soils from the OU-2 source areas exhibit the characteristics of a RCRA hazardous waste; however, no soils have been identified to date. RCRA regulations will be applicable to the storage and disposal of any RCRA hazardous waste;

- Federal Clean Air Act (42 United States Code 7401), as amended, is applicable for venting contaminated vapors;

- Alaska Air Quality Control Regulations (18 AAC 50). Although on-site remedial actions do not require permitting, the substance portion of these regulations must be met for the venting of contaminated vapors associated with operation of the air sparging, SVE, or LTTD; and

- Alaska Solid Waste Management Regulations (18 AAC 60) must be met for proper management and transport of wastes that meet the definition of a RCRA hazardous waste but contain contaminants that exceed cleanup levels.

8.2.5 Information To-Be-Considered

The following information TBC will be used as a guideline when implementing the selected remedy:

- State of Alaska Interim Guidance for Non-UST Contaminated Soil Cleanup Levels (July 17, 1991) for the Building 1168 Leach Well;

- State of Alaska Guidance for Storage, Remediation, and Disposal of Non-UST Petroleum-Contaminated Soils (July 29, 1991) for the Building 1168 Leach Well; and

- State of Alaska Interim Guidance for Surface and Groundwater Clean-

up Levels (September 26, 1990) for both source areas.

8.3 COST EFFECTIVENESS

The selected remedies provide an overall effectiveness proportionate to their costs, such that they represent a reasonable value for the money spent.

8.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The Army, State of Alaska, and EPA have determined that the selected remedies represent the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner at the OU-2 source areas. Of those alternatives that protect human health and the environment and comply with ARARs, the Army, State of Alaska, and EPA have determined that the selected remedies provide the best balance of trade-offs in terms of long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; cost; and the statutory preference for treatment as a principal element in considering state and community acceptance.

8.5 PREFERENCE FOR TREATMENT AS A MAIN ELEMENT

The selected remedy for each source area satisfies the statutory preference for treatment for soil and groundwater.

9.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The selected remedy for the DRMO Yard and Building 1168 Leach Well source areas is the same preferred alternative for each area presented in the Proposed Plan. No changes in the components of the preferred alternative have been made.

APPENDIX A

FORT WAINWRIGHT
COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT
FEDERAL FACILITY AGREEMENT
RECOMMENDED ACTION DOCUMENTS

CONTENTS

FORT WAINWRIGHT

CERCLA FEDERAL FACILITY AGREEMENT

RECOMMENDED ACTION

Source Area: 801 Drum Burial Site
Engineer Park Drum Site
Drum Site South of Landfill

Recommended Action: Referral from Operable Unit 2 to Operable Unit 1.

Background: A removal action was completed on these source areas in 1992. The information needed to adequately assess further actions was not received in time to meet the schedule of Operable Unit 2. It was agreed by the Project Managers to move these source areas to Operable Unit 1.

Comments:

Approvals: The following project managers, representing their respective agencies which are signatories to the FFA, concur with this evaluation.

Rielle Markey — 2-4-94

Rielle Markey — Date
Alaska Department of Environmental Conservation
Remedial Project Manager

Dianne Soderlund — 2/4/94

Dianne Soderlund — Date
US Environmental Protection Agency
Remedial Project Manager

Cristal Fosbrook — 4 Feb 94

Cristal Fosbrook — Date
6th Division (Light), US Army Garrison
Directorate of Public Works
Remedial Project Manager

Revised 3 June 94

FORT WAINWRIGHT

CERCLA FEDERAL FACILITY AGREEMENT

RECOMMENDED ACTION

Source Area: Tar Sites

Recommended Action: No Further Action

Background: After evaluation of all available historical information and interviews with individuals having an institutional knowledge of Fort Wainwright (FWA), site visit and review of analytical data, no further action (NFA) is planned for this source based on one or more of the following reason:

1. 1992 analytical results.

A systematic, qualitative approach has been used to determine the disposition of this potential source of contamination which is consistent with RI/FS guidance and Superfund objectives. This approach is based on a conceptual model of this particular source, the ultimate risk to human health or the environment that it represents, and analytical results. If, at any juncture, additional information becomes available which alters the information used in this decision, the source will be reevaluated.

This decision document will become part of the Record of Decision (ROD) for Operable Unit (OU) 2, as designated by the Federal Facility Agreement (FFA), which was signed by US Environmental Protection Agency (EPA) the Alaska Department of Environmental Conservation (ADEC) and the US Army.

Location: West of the FWA South Post Soccer Field; at Glass park next to Building 4040; northwest of the FWA Golf Course; and west of the power plant cooling pond next to the railroad.

History: Reportedly the sites were used as tar disposal areas. Based on a concern of possible leachate release from these sites, they were included in the FFA as sources that needed further investigation. A sampling effort was conducted in June and July of 1992. The results we summarized in U.S. Army Corps of Engineers memorandum dated October 7th and 15th 1992.

Summary: The criteria used in the decision process for this site is as follows:

- During a 1992 sampling effort the source areas were located and tar samples were collected for Toxicity Characteristic Leaching Procedure (TCLP) analysis; The analytical results indicate that there is no potential for groundwater contamination.

Based on the above information, there is no evidence that a potential source of contamination exists at these sites.

Reference: October 7th and 15th chemical analysis results of the samples collected in June and July of 1992.

Comments:

Future actions with these sites should be coordinated with the Solid Waste / Pollution Prevention program of AK. Dept. of Environmental Conservation.

Rielle Marbery
7-25-94

TAR SITES NO FURTHER ACTION

Approvals: The following project managers, representing their respective agencies which are signatories to the FFA, concur with this evaluation.

Rielle Markey — 7-25-94
Rielle Markey — Date
Alaska Department of Environmental Conservation
Remedial Project Manager

Dianne Soderlund — 6/15/94
Dianne Soderlund — Date
US Environmental Protection Agency
Remedial Project Manager

Cristal Fosbrook — 3 June 94
Cristal Fosbrook — Date
6th Division Light/US Army Garrison
Directorate of Public Works
Remedial Project Manager

Revised 3 June 94

FORT WAINWRIGHT

CERCLA FEDERAL FACILITY AGREEMENT

RECOMMENDED ACTION

Source Area: Engineer Park Drum Site

Recommended Action: No Further Action (NFA).

Background: After evaluation of all available historical information, interviews with individuals having an institutional knowledge of Fort Wainwright, site visits, and review of analytical data, no further action is planned for this source based on the following reasons:

1. In 1992, 680 drums were removed.

2. Results of 1992 and 1993 limited field investigations.

A systematic, qualitative approach has been used to determine the disposition of this potential source of contamination which is consistent with RI/FS guidance and Superfund objectives. This approach is based on a conceptual model of this particular source and the ultimate risk to human health or the environment that it represents. If at any juncture, additional information becomes available which alters the information used in this decision, the source will be reevaluated.

This decision document will become part of the Record of Decision (ROD) for Operable Unit (OU) 1, as designated by the Federal Facility Agreement (FFA), which was signed by the Alaska Department of Environmental Conservation (ADEC), the US Environmental Protection Agency (USEPA), and the US Army. This source was moved from OU2 to OU1 as part of a Recommended Action dated February 4, 1994.

Location: This source is located on the northeast side of Engineers Park on the south bank of the Chena River. See attached map of source area.

History: Disposal of drums at this location began after the August 1967 flood.

Summary: The criteria used in the decision process for this site is as follows:

- A drum removal was conducted in August and September of 1992. The drum removal activities at this site included removing unburied drums. A total of 680 drums were removed, 613 of the drums found were empty and 67 contained material. The drums contained gasoline, kerosene, degreasing solvents and PCE.

- During a 1992 investigation ten surface soils samples were taken. Low levels of semivolatile organic compounds were detected. The maximum detected site concentration of the suspected contaminates were compared to EPA Regions 10's Risk-Based-Concentrations, which were used as conservative screening values. The comparison indicates no unacceptable potential risks to human health or the environment.

- During 1993 ground penetrating radar (GPR) was conducted with no additional drums being located. Additionally, eleven surface samples were taken and two soil borings were completed as monitoring wells. The maximum detected site concentration of the suspected contaminates were compared to EPA Regions 10's Risk-Based-Concentrations and the comparison indicates no unacceptable risks to human health or the environment.

- In both sampling events an observational approach was employed to assure samples represented potential worst case contamination.

- Detected concentrations of soil with Di-n-butylphthalate were determined to be laboratory contaminates.

- All detected concentrations in groundwater data were determined to be laboratory contaminates.

Based on the above information there is no evidence that a contaminant release has occurred at this source area which poses an inacceptable risk to human health or the environment.

References:

Preliminary Source Evaluation 2, Blair Lakes and Drum Sites, Fort Wainwright, AK, Harding Lawson and Associaties, March 1994

Final Report for Drummed Waste Removal, Fort Wainwright, Fairbanks, Alaska, Volume I, II, and III, OHM Remediation Services Corporation, February 1993

Comments:

Engineer Park Drum Site-No Further Action

Approvals: The following project managers, representing their respective agencies which are signatories to the FFA, concur with this evaluation.

Rielle Markey — 7-25-94

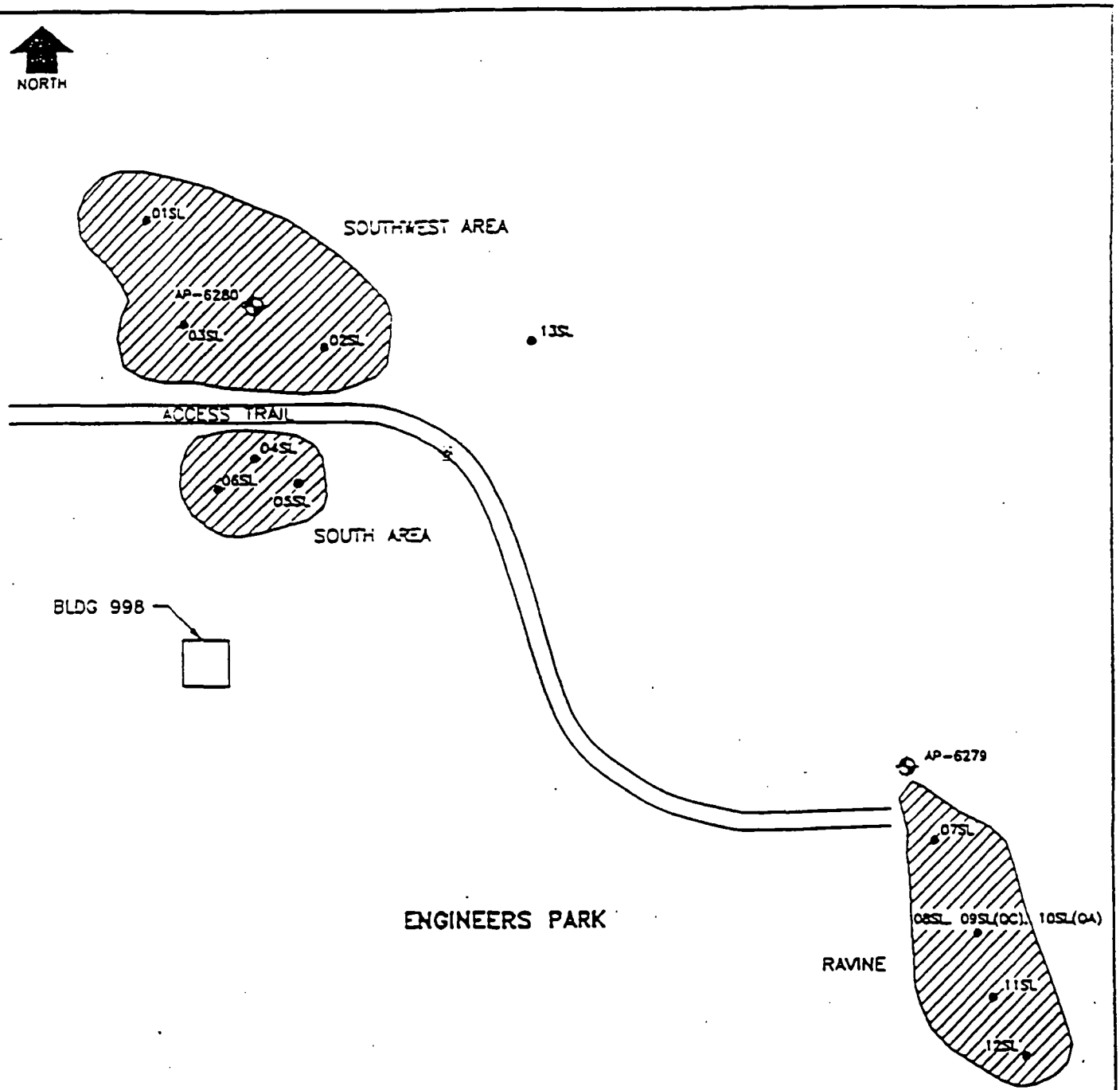
RIELLE MARKEY — Date
Alaska Department of Environmental Conservation
Remedial Project Manager

Dianne Soderlund — 6/16/94

DIANNE SODERLUND — Date
US Environmental Protection Agency
Remedial Project Manager

Cristal Fosbrook — 7/25/94

CRISTAL FOSBROOK — Date
6th Division (Light), US Army Garrison
Directorate of Public Works, Alaska
Remedial Project Manager



LEGEND

AP-6279 — MONITORING WELL LOCATION AND USACE NUMBER

12SL • — SURFACE-SOIL SAMPLE LOCATION AND NUMBER.

APPROXIMATE LOCATIONS OF DRUM REMOVAL ACTIVITIES

NOTES:
- SAMPLE PREFIX HAS BEEN OMITTED FOR BREVITY. THE PREFIX FOR THE ENGINEERS PARK SAMPLES IS 93FWEP.
- (OA) QUALITY ASSURANCE DUPLICATE SAMPLE
- (OC) QUALITY CONTROL DUPLICATE SAMPLE

LOCATIONS OF SURFACE-SOIL SAMPLES ARE APPROXIMATE.

SOURCE: MODIFIED FROM BLIZZARD ALASKA SURVEYS, SITE LOCATION SURVEY DEC. 15, 1992, JOB 9217, SHT 1 OF 4

SCALE: 1" = 40'

Harding Lawson Associates
Engineering and Environmental Services

Site Plan
Engineers Park
Operable Unit 1, Preliminary Source Evaluation 2
Fort Wainwright, Alaska

DRAFT

PLATE 4

DRAWN	PROJECT NUMBER	APPROVED	DATE	FILE NAME
JP	24549	SLA	9/93	235J

FORT WAINWRIGHT

CERCLA FEDERAL FACILITY AGREEMENT

RECOMMENDED ACTION

Source Area: Building 3477 - Battery Storage Area

Recommended Action: No Further Action

Background: Based on a review of all available historical information, interviews with individuals having an institutional knowledge of Fort Wainwright and, if possible, this site, and a limited field investigation. No further action (NFA) is planned for this source based on one or more of the following reasons:

1. Interviews with individuals confirming the source existed.

2. Results of a 1992 limited field investigation at the source indicates no real potential risks to human health or the environment exists at the battery storage area.

A systematic, qualitative approach has been used to determine the disposition of this potential source of contamination which is consistent with RI/FS guidance and Superfund objectives. This approach is based on a conceptual model of this particular source and the ultimate risk to human health or the environment that it represents. If, at any juncture, additional information becomes available which alters the information used in this decision, the source will be reevaluated.

This decision document will become part of the Record of Decision (ROD) for Operable Unit (OU) 2, as designated by the Federal Facility Agreement (FFA), the Alaska Department of Environmental Conservation (ADEC) and the US Army on February 12, 1993.

Location: The battery storage area is located on the east side of Building 3477. Building 3477 is on Chippewa Avenue, approximately 1/4 mile northeast of the South Gate House.

History: Building 3477 was constructed 1955 as a vehicle maintenance facility. The building is currently used for vehicle and equipment maintenance. The site had been used for servicing and storing batteries for an unknown period. These practices were discontinued in 1990, and the U.S. Army contracted for the battery servicing area to be cleaned. The area on the east side of the building

was used for temporary storage of batteries that were to be disposed of. Based on the potential for contaminant release from this site, it was included in the FF as a source that needed further investigation through the Preliminary Source Evaluation (PSE) 2 process. A draft PSE report was published November 4, 1992.

Summary: The criteria used in the decision process for this site is as follows:

- During interviews with former US Army personnel, one soldier stated the site was no longer used as a storage area for batteries that were to be disposed of.

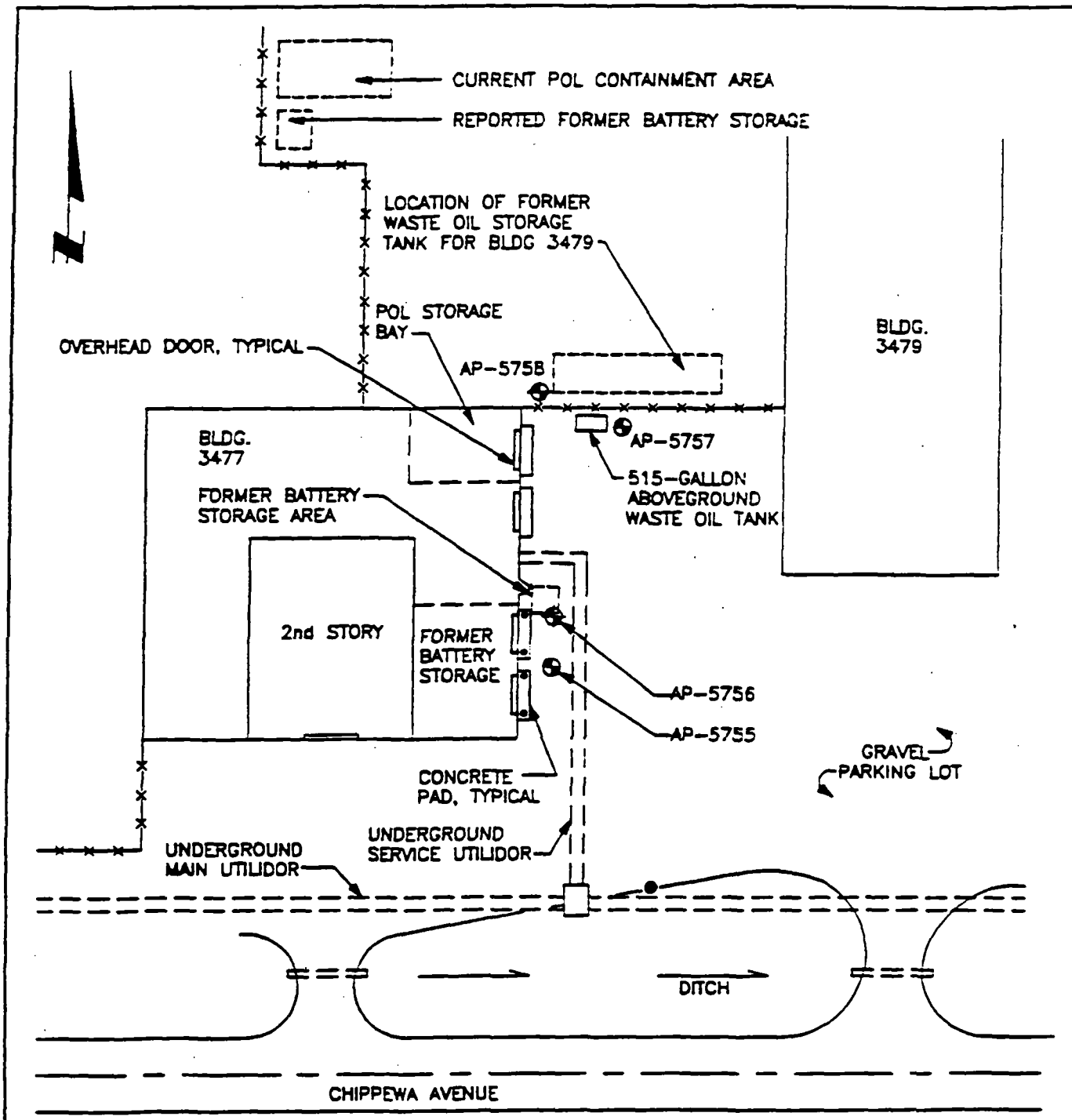
- During interviews with current and former employees (the site was identified a an area of building 3477).

- During a 1192 limited field investigation samples were collected. The maximum detected site concentrations of the suspected contaminates were compared with EPA Region 10's Risk-Based Concentrations and the comparisc indicates no real or potential risks to human health or the environment exists at the battery storage area. Attachment 1 includes a plot plan of this source.

- Based on the above information, there is no evidence that a potential source of contamination exists at this site.

Reference: Final Report. Operable Unit 2, Preliminary Source Evaluation 2, Phase 1, Fort Wainwright, Alaska.; Harding Lawson and Associates, April 23, 1993.

Comments:



LEGEND:

- CHAIN-LINK FENCE
- POWER POLE
- SOIL BORING
- BORING/MONITORING WELL

0 25 50 100

SCALE IN FEET

REFERENCE: CORPS OF ENGINEERS, FIELD MAINTENANCE SHOP, DRAWING NUMBER 35-32-07

Harding Lawson Associates
Engineering and Environmental Services

Site Plan, Building 3477
FWA-020
Operable Unit 2, Preliminary Source Evaluation 2, Phase 1
Fort Wainwright, Alaska

PLATE 4

DRAWN	PROJECT NUMBER		APPROVED	DATE	FILE NAME
TZ	10789	125	MJD	10/92	043T

Approvals: The following project managers, representing their respective agencies which are signatories to the FFA, concur with this evaluation.

Rielle Markey — 1/13/94

Rielle Markey
Alaska Department of Environmental Conservation
Remedial Project Manager

Date

Dianne Soderlund — 1/13/94

Dianne Soderlund
US Environmental Protection Agency
Remedial Project Manager

Date

Cristal Fosbrook — 13 Jan 94

Cristal Fosbrook
6th Division Light/US Army Garrison
Directorate of Public Works
Remedial Project Manager

Date

Revised 3 June 94

FORT WAINWRIGHT

CERCLA FEDERAL FACILITY AGREEMENT

RECOMMENDED ACTION

Source Area: *Drum Site South of Landfill*

Recommended Action: No Further Action (NFA).

Background: After evaluation of all available historical information, interviews with individuals having an institutional knowledge of Fort Wainwright, site visits, and review of analytical data, no further action is planned for this source based on the following reasons:

1. In 1992, 573 drums were removed.

2. Results of 1992 and 1993 limited field investigations.

A systematic, qualitative approach has been used to determine the disposition of this potential source of contamination which is consistent with RI/FS guidance and Superfund objectives. This approach is based on a conceptual model of this particular source and the ultimate risk to human health or the environment that it represents. If at any juncture, additional information becomes available which alters the information used in this decision, the source will be reevaluated.

This decision document will become part of the Record of Decision (ROD) for Operable Unit (OU) 1, as designated by the Federal Facility Agreement (FFA), which was signed by the Alaska Department of Environmental Conservation (ADEC), the US Environmental Protection Agency (USEPA), and the US Army. This source was moved from OU2 to OU1 as part of a Recommended Action dated February 4, 1994.

Location: This source is located on the south of the landfill and includes drum areas, referred to as the east and west drum sites. See attached map of source area.

History: Historical information and records on drum disposal at this location were not available. The site was identified in the RCRA Facility Assessment as a potential source.

Summary: The criteria used in the decision process for this site is as follows:

- A drum removal was conducted in August and September of 1992. The drum removal activities at this site included removing unburied drums. A total of 573 drums were removed, 474 of the drums found were empty and 99 contained material. The drums contained gasoline, kerosene and degreasing solvents.

- During a 1992 investigation eleven surface soils samples were taken. Low level semivolatile organic compounds were detected. The maximum detected site concentration of the suspected contaminates were compared to EPA Regions 10 Risk-Based-Concentrations, which were used as conservative screening values. These levels are within the 10-4 to 10-6 acceptable risk range as specified in 300.430(e)(2)(i)(A)(2) of the National Contingency Plan (NCP).

- During 1993 ground penetrating radar (GPR) was conducted with no additional drums being located. Additionally, eleven surface samples were taken and two s borings were completed as monitoring wells. Low levels of semivolatile organic compounds were detected in groundwater. The maximum detected site concentration of the suspected contaminates were compared to EPA Regions 10 Risk-Based-Concentrations, which were used as conservative screening values. These levels are within the 10-4 to 10-6 acceptable risk range as specified in 300.430(e)(2)(i)(A)(2) of the National Contingency Plan (NCP). Attachment 2 includes pertinent analytical data.

- In both sampling events an observational approach was applied to assure samp were taken in areas representing potential worst case contamination.

- Detected concentrations of Di-n-butylphthalate and Bis(2 etthylhexyl)pthaltate i soil were determined to be laboratory contaminates.

Based on the above information, there is no evidence that a contaminant release ha occurred which poses an unacceptable risk to human health or the environment.

References:

Preliminary Source Evaluation 2, Blair Lakes and Drum Sites, Fort Wainwright, AK, Harding Lawson and Associaties. March 1994

Final Report for Drummed Waste Removal, Fort Wainwright, Fairbanks, Alaska, Volume I, II, and III, OHM Remediation Services Corporation, February 1993

Comments

ATTACHMENT 2

Table 4-5. Analytes Detected in Water Samples From the East and West Drum Sites

U.S. Army Corps of Engineers Boring Number	AP-6277	AP-6278	AP-6278	
Sample Number	FWED01WA	FWWD01WA	FWWD02WA	F
Laboratory Sample Number	9492-7	9492-8	9492-5	
Duplicate Qualifier	N/A	N/A	CC	
Associated Project Sample Number	N/A	N/A	FWWD01WA	F

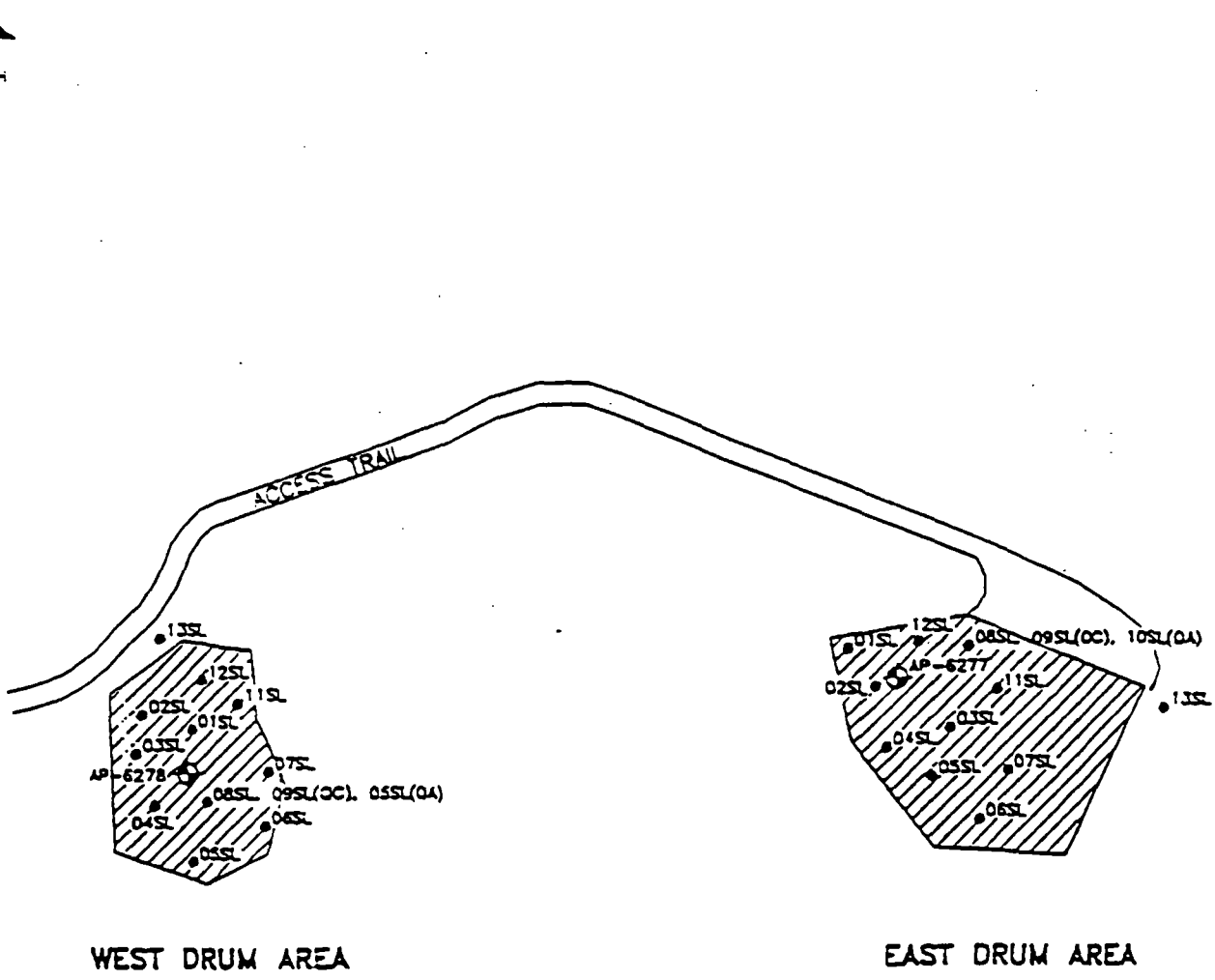
Analyte	EPA Method	Units			
Fuel Quantitation and Identification					
Diesel Fuel (as #2)	8015M[a]	mg/L	0.08	--	ND(0.05)
Bunker Oil (as #6 Diesel)	8015M[a]	mg/L	0.34*	--	0.48*
Gasoline Range Organics	8015M[b]	No analytes detected above the method reporting lim			
Diesel Range Organics					
DRO	8100M[b]	mg/L	0.19*	0.28*	0.26*
Volatile Organic Compounds					
Number of TICs	8260	N/A	2	1 ǂ	2 ǂ
Sum of estimated TIC concentration	8260	µg/L	16	5 ǂ	15 ǂ
Semivolatile Organic Compounds					
Di-n-butylphthalate	8270	µg/L	15 B	32 B	7 B,E
bis(2-Ethylhexyl)phthalate	8270	µg/L	46	ND(10)	10 E
Number of TICs	8270	N/A	2	3	1
Sum of estimated TIC concentration	8270	µg/L	676	33	8
Organochlorine Pesticides and PCBs	8080	No analytes detected above the method reporting lim			
Organophosphorus Pesticides	8140	No analytes detected above the method reporting lim			
Metals					
Arsenic	7060	mg/L	0.0036	0.012	0.011
Barium	6010	mg/L	0.2	0.18	0.17
Calcium	6010	mg/L	--	--	--
Iron	6010	mg/L	--	--	--
Lead	7421	mg/L	0.0014	ND(0.0010)	0.0025
Magnesium	6010	mg/L	--	--	--
Manganese	6010	mg/L	--	--	--
Potassium	6010	mg/L	--	--	--
Sodium	6010	mg/L	--	--	--

[a] U.S. Army Corps of Engineers Modified Method 8015M.
[b] Alaska Department of Environmental Conservation Modified Methods 8015M and 8100M.

-- = Not applicable.
EPA = Environmental Protection Agency.
mg/L = Milligrams per liter.
N/A = Not applicable.
ND = Not detected above method reporting limit shown in parentheses.
PCBs = Polychlorinated biphenyls.
TICs = Tentatively identified compounds.
µg/L = Micrograms per liter.

Project Laboratory Qualifiers
B = Indicates the analyte was found in the blank as well as the sample.
E = Indicates estimated concentration.

Chemical Quality Assurance Report (CQAR) Qualifiers
* = Data should be considered with caution (see CQAR, Appendix F).
ǂ = The CQAR deem the data unacceptable.



LEGEND

AP-6279 ⊕ MONITORING WELL LOCATION AND USACE NUMBER

12SL • SURFACE-SOIL SAMPLE LOCATION AND NUMBER.

▨ APPROXIMATE LOCATIONS OF DRUM REMOVAL ACTIVITIES

NOTES:
- SAMPLE PREFIX HAS BEEN OMITTED FOR BREVITY. THE PREFIX FOR THE EAST DRUM SAMPLES IS 93FWED AND FOR WEST DRUM SAMPLES 93FWWD.
- (QA) QUALITY ASSURANCE DUPLICATE SAMPLE
- (QC) QUALITY CONTROL DUPLICATE SAMPLE
- LOCATIONS OF SURFACE-SOIL SAMPLES ARE APPROXIMATE.

SOURCE: MODIFIED FROM BLIZZARD ALASKA SURVEYS. SITE LOCATION SURVEY DEC. 15, 1992. JOB 9217. SHT 1 OF 4

SCALE: 1" = 150'

Drum Site South of Landfill

Harding Lawson Associates
Engineering and Environmental Services

Site Plans
East and West Drum Areas
Operable Unit 1, Preliminary Source Evaluation 2
Fort Wainwright, Alaska

DRAFT

5

DRAWN	PROJECT NUMBER	APPROVED	DATE	FILE NAME
JP	24549	JLA	9/93	235J

Drum Site South of Landfill-No Further Action

Approvals: The following project managers representing their respective agencies which are signatories to the FFA, concur with this evaluation.

Rielle Markey 7-25-94

RIELLE MARKEY Date
Alaska Department of Environmental Conservation
Remedial Project Manager

Dianne Soderlund 6/16/94

Dianne Soderlund Date
US Environmental Protection Agency
Remedial Project Manager

Cristal Fosbrook 3 June 94

Cristal Fosbrook Date
6th Division (Light), US Army Garrison
Directorate of Public Works, Alaska
Remedial Project Manager

APPENDIX B

ADMINISTRATIVE RECORD INDEX

Fort Wainwright Administrative Record
List of Documents Pertaining to OU 2

Original Doc. Date	Title	Document Type	Author Name	Author Organization	Recipient Name	Recipient Organization	Start Page	End Page
6/1/86	Preliminary Radar Survey of a Hazardous Waste Dump--North Post Site	Report	Steven A. Arcone	CRREL	Cristal Fosbrook	DPW	02078	02141
10/1/86	Endangerment Assessment for FTW 150 Unit Family Housing Project--Data Acquisition Plan	Report	None given	URS Corporation	None given	COE	02142	02210
4/1/87	Confirmation Study: Endangerment Assessment for FTW Family Housing Area; included Appendices Volumes 1 & 2	Report	None given	URS Corporation	None given	COE	02211	02822
11/1/88	Risk Assessment for Proposed Family Housing Facilities, FTW	Report	None given	Ecology & Environment	CENPA-EN-PM-A	COE	02823	03102
7/7/89	Trip Report, Chena Project, IRP Projects on FTW and Ft. Greely	Memorandum	Georgeanne Reynolds	COE	None given	None given	03109	03116
7/21/89	ADEC Review Comments for Sampling Plan--IRP North Post Family Housing	Letter	Douglas Lowery	ADEC	Eddie Brooks	COE	05118	05120
8/15/89	Memorandum for Record: Tar Seepage in the Chena River	Memorandum	Bill Quirk	DEH	File	File	03103	03104
9/7/89	Trip Report, FTW, Ft. Greely	Memorandum	Dan Knight	COE	None given	None given	03105	03108
2/9/90	Letter Addressing Groundwater Contamination at North Post Site on FTW	Letter	Jon Sandquist	Ecology & Environment	Eddie Brooks	COE	05243	05244
2/9/90	Discussion of Army Request for Interpretation of Groundwater Analytical Data and Their Effect on Remedial Approach for North Post Site	Letter	Jon Sundquist	Ecology & Environment	Eddie Brooks	COE	05764	05765
3/1/90	EPA Review Comments on Project Report for North Post Site, FTW	Letter	Douglas Johnson	EPA	Col. Edwin Ruff	DEH	03249	03251
4/3/90	ADEC Review Comments for Draft Project Report for North Post Site, FTW	Letter	Douglas Dasher	ADEC	Paul Steucke	Env. Res. Div.	03252	03256
4/9/90	Memorandum for Record, Trip Report, Site Investigation of 5 FTW IRP Sites	Memorandum	David Williams	COE	File	File	03117	03121
5/1/90	Project Report for the North Post Site, FTW	Report	None given	Ecology & Environment	Mark Wallace	COE	03122	03241
5/21/90	Notice of Availability and Comment Period	Notice	William Kakel	COE	Public	Public	08303	08303
6/20/90	ADEC Response to EA & FNSI for North Post Site on Fort Wainwright	Letter	Rielle Markey	ADEC	William Kakel	COE	05240	05242
7/2/90	Remedial Action Required at North Post Site, FTW	Fact Sheet	Catherine Scott	US Army	None given	None given	08304	08304
9/2/90	Army Monitors Waste Site	Article	Kris Capps	Fairbanks Daily News-Miner	Public	Public	05246	05247
5/1/91	Design Analysis for Soil Remediation Project at the North Post Site, FTW	Report	None given	Ecology & Environment	Mark Wallace	COE	07429	07456
5/24/91	Review of Planned Removal Action at North Post Site, FTW	Memorandum	Paul Thies	COE	Cristal Fosbrook	DPW	07425	07428

Fort Wainwright Administrative Record
List of Documents Pertaining to OU 2

Original Doc. Date	Title	Document Type	Author Name	Author Organization	Recipient Name	Recipient Organization	Start Page	End Page
8/1/91	Bidding Documents for IRP North Post Site Soil Remediation, FTW	Report	None given	COE	Contractors	Contractors	05248	05680
10/17/91	Fort Wainwright Solid Waste Management Units, 1991 Site Reconnaissance, FTW Site Safety Plan.	Report	Garson Carothers	Harding Lawson	Mark Wallace	COE	03257	03280
11/20/91	Non-Invasive Site Investigation, SWMU FTW	Report	Garson Carothers	Harding Lawson	CENPA-EN-MB-C	COE	04134	04169
1/9/92	Site Safety and Health Plan, Preliminary Source Evaluation, Fort Wainwright, Alaska	Report	James Slattery	Harding Lawson	Mark Wallace	COE	03281	03358
2/14/92	DRAFT Chemical Data Acquisition Plan PSE, FTW	Report	Garson Carothers	Harding Lawson	Mark Wallace	COE	03359	03488
5/28/92	Work Plan, OU2, PSE2, Phase 1, FTW	Report	Shaun Sexton	Harding Lawson	CENPA-EN-MB-C	COE	03489	03669
6/23/92	Review Comments for OU2, PSE2, Phase 2 DRMO	Letter	Ronan Short	ADEC	Cristal Fosbrook	DPW	05121	05122
6/23/92	Review Comments for Draft Scope of Work for OU2, PSE2, Phase 2	Letter	Dianne Soderlund	EPA	Cristal Fosbrook	DPW	05123	05126
7/28/92	Non-Invasive Site Investigation, DRMO, OU2, PSE2, Phase 2	Report	Sandra Draper	Harding Lawson	CENPA-EN-MB-C	COE	04170	04189
8/12/92	Results of Chemical Analyses	Memorandum	Timothy Seeman	NPDML	Commander	US Army, AK Dist	04190	04223
8/13/92	Preliminary Summary of Invasive Investigation, SWMU OU2, PSE2, Phase 1	Letter	Shaun Sexton	Harding Lawson	Mark Wallace	COE	04224	04232
9/8/92	Review Comments for Draft Work Plan for DRMO Storage Yard, PSE2, Phase 2	Letter	Cami Grandinetti	EPA	Cristal Fosbrook	DPW	05127	05129
9/17/92	Work Plan, DRMO, OU2, PSE2, Phase 2	Report	William Burgess	Harding Lawson	Mark Wallace	COE	03670	03830
9/18/92	Site Safety and Health Plan, OU2, PSE2, Phase 2	Report	Sandra Draper	Harding Lawson	Mark Wallace	COE	03831	03950
10/5/92	Results of Chemical Analyses	Memorandum	Timothy Seeman	NPDML	Commander	US Army, AK Dist	04233	04238
10/7/92	Chemical Analysis Results: Tar Pit	Memorandum	Delwyn Thomas	COE	CENPA-EN-EE-AI	US Army	04239	04276
10/15/92	Chemical Analysis Results: Tar Pit 2	Memorandum	Delwyn Thomas	COE	CENPA-EN-EE-AI	US Army	04277	04282
10/26/92	Preliminary Summary of Invasive Investigation	Letter	Sandra Draper	Harding Lawson	Mark Wallace	COE	04283	04286
11/1/92	Investigations of Buried Drum Sites by Ground Penetrating Radar	Report	Daniel Lawson	CRREL	None given	COE	03242	03248
12/1/92	Biodegredation/Volatilization Bench Scale Treatability Study Results for TPH Contaminated Soils Located at the North Post Site	Report	None given	Laidlaw Env. Svcs.	None given	COE	08034	08302

Fort Wainwright Administrative Record
List of Documents Pertaining to OU 2

Original Doc. Date	Title	Document Type	Author Name	Author Organization	Recipient Name	Recipient Organization	Start Page	End Page
1/24/93	Review Comments for OU2, PSE2, Phase 1 Report	Letter	Dianne Soderlund	EPA	Cristal Fosbrook	DPW	05130	05136
2/1/93	Sampling and Analytical Final Report for Drummed Waste Removal	Report	Thomas Warren	OHM Remed. Svcs.	None given	COE	05766	06775
2/1/93	Operations Final Report for Drummed Waste Removal, Ft. Wainwright	Report	Thomas Warren	OHM Remed. Svcs.	None given	COE	06776	07108
2/1/93	Health & Safety Final Report for Drummed Waste Removal, Ft. Wainwright	Report	Thomas Warren	OHM Remed. Svcs.	None given	COE	07109	07407
3/26/93	Review Comments for Final Report for OU2, PSE2, Phase 2, DRMO	Letter	Ronan Short	ADEC	Cristal Fosbrook	DPW	05137	05138
4/20/93	Temporary Stockpile Plan North Post Site, FTW	Report	None given	Laidlaw Env. Svcs.	None given	COE	05681	05691
4/21/93	Final Report OU2, Preliminary Source Evaluation 2, Phase 1,	Report	Shaun Sexton	Harding Lawson	CENPA-EN-EE-AI	COE	04287	04580
4/21/93	ADEC Review Comments for Treatability Study, North Post Sites 3 & 4	Letter	Rielle Markey	ADEC	Cristal Fosbrook	DPW	07457	07459
5/20/93	Notice of Violations During Remediation of Contaminated Soils at Sites 3 & 4 at North Post Site	Letter	Rielle Markey	ADEC	Robert Wrentmore	USArmy	07460	07460
6/16/93	Final Report, Operable Unit 2, PSE 2, Phase 2, Defense Reutilization Marketing Office, Fort Wainwright, Alaska; 2 volumes	Report	Paul Adel	Harding Lawson	CENPA-EN-EE-AI	COE	23684	24200
6/17/93	Summary of Soil Sample Results for North Post Site Soil Remediation Project	Report	CPT Malsom	US Army	Joe Malen	DEH	07408	07424
6/21/93	Biopile Work Plan North Post Site Soil Remediation, FTW	Report	None given	Laidlaw Env. Svcs.	None given	COE	05692	05763
7/20/93	Final Report, OU2, PSE2, Phase 2, DRMO, FTW	Report	Paul Adel	Harding Lawson	None given	COE	04721	05103
7/30/93	Work Plan, OU2, PSE2, Support Work	Report	Timothy Gould	Harding Lawson	None given	COE	03951	04133
7/30/93	Results of Chemical Analyses, FTW DRMO	Report	Timothy Seeman	COE-NPDL	CENPA-EN-G-MI	COE	05104	05117
8/9/93	Final Chemical Data Report for Pond Near Badger Road	Report	CENPA-EN-G-MI	COE	CENPA-EN-EE-AI	COE	05139	05177
8/23/93	DRAFT OU2 RI/FS Management Plan	Report	None given	Harding Lawson	None given	None given	07461	08033
4/6/94	Final Management Plan, Operable Unit 2, Fort Wainwright, Alaska	Report	Michael J. Schmetzer	Harding Lawson	None given	COE	34940	35955
4/26/94	Preliminary Source Evaluation 2; Support Work; 801 Drum Burial Site; Fort Wainwright, Alaska	Report	Steven C. Gruhn	Harding Lawson Associates	Mark Wallace	COE	21666	21850
4/29/94	Operable Unit 2; Preliminary Source Evaluation 2; Support Work; Building 1168; Fort Wainwright, Alaska	Report	Steven C. Gruhn	Harding Lawson Associates	Mark Wallace	COE	22098	22319

Fort Wainwright Administrative Record
List of Documents Pertaining to OU 2

Original Doc. Date	Title	Document Type	Author Name	Author Organization	Recipient Name	Recipient Organization	Start Page	End Page
7/21/94	Qualitative Ecological Risk Assessment Approach, Remedial Investigation, Operable Unit 2, Fort Wainwright, Alaska	Report	Michael J. Schmetzer	Harding Lawson	CENPA-EN-EE-AI	COE	26837	26844
7/22/94	Groundwater Levels at DRMO and Building 1168, Fort Wainwright, Alaska	Memorandum	Delwyn Thomas	COE	CENPA-EN-EE-AI	COE	26735	26754
8/1/94	Investigation, Site Assessment, and Recommendations, Building 1168, August 1994	Report	John H. Janssen	Oil Spill Technology, Inc.	None given	COE	37864	38125
12/14/94	Work Plan Building 1168 Treatability Study, Fort Wainwright, Alaska	Report	Timothy Gould	Harding Lawson	None given	COE	24842	24900
1/10/95	Operable Unit 2 Baseline Human Health Risk Assessment Approach, Fort Wainwright, Alaska	Report	Michael J. Schmetzer	Harding Lawson	CENPA-EN-EE-AI	COE	24735	24764
1/31/95	Interim Report, Building 1168 Treatability Study, Fort Wainwright, Alaska	Report	Joseph W. McElroy	Harding Lawson	None given	COE	27252	29025
5/15/95	Building 1168 Treatability Study Offgas Assessment	Report	Tim Gould	Harding Lawson Associates	Mark Wallace	COE	48750	48766
7/1/95	Final Site Safety and Health Plan, Fort Wainwright Buildings 1002, 1168, and 2250	Report	None given	ENSR Consulting and Engineering	None given	COE		
7/1/95	Final Work Plan for Release Investigations Building 1002, 1168, and 2250, Fort Wainwright, Alaska	Report	None given	ENSR Consulting and Engineering	None given	COE		
10/13/95	Technical Memorandum, Underground Storage Tank Release Investigations at the North Post and DRMO Sites, Project No. 33414 and 33415	Report	J. Robert Allen	Harding Lawson Associates	None given	COE	37809	37818
10/16/95	Final Human Health Risk Assessment, OU2, Delivery Order 002	Report	Douglas N. Cox	Harding Lawson Associates	Mark Wallace	COE	39929	40222
12/1/95	Review Comments on Final Human Health Risk Assessment, Operable Unit 2, Fort Wainwright, Alaska, October 1995	Letter	Jack M. Heller	US Army Center for Health Promotion	Mark Wallace	COE		
12/20/95	Release Investigation Report, North Post Site 4, Fort Wainwright, Alaska	Report	Karol Lorraine, J. Robert Allen	Harding Lawson Associates	Mark Wallace	COE		
1/12/96	Technical Memorandum, Monitoring Results, Building 1168 Treatability Study, Fort Wainwright, Alaska	Memorandum	Joseph W. McElroy, Timothy F. Gould	Harding Lawson Associates	Mark Wallace	COE		
1/16/96	Request for Extension of Document Deadline for the Operable Unit 2 Record of Decision	Letter	Albert J. Kraus	US Army Directorate of Public Works	D. Soderlund; R. Markey	US EPA Reg X; ADEC		
1/25/96	Operable Unit 2 Final Remedial Investigation Report, Fort Wainwright, Alaska, Volumes I, II, III	Report	Michael Schmetzer, George Drewett	Harding Lawson Associates	Mark Wallace	COE		

Fort Wainwright Administrative Record
List of Documents Pertaining to OU 2

Original Doc. Date	Title	Document Type	Author Name	Author Organization	Recipient Name	Recipient Organization	Start Page	End Page
4/1/96	Fort Wainwright Proposed Plan for Remedial Action at Operable Unit 2	Report	None given	None given	Public	Public		
	FONSI and EA for the North Post Site	Report	None given	COE	Cristal Fosbrook	DPW	05178	05239
	Tar from Old Dump May Seep into Chena River	Article	None given	None given	Public	Public	05245	05245

APPENDIX C

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY FOR THE RECORD OF DECISION FOR REMEDIAL ACTION AT OPERABLE UNIT 2, FORT WAINWRIGHT, ALASKA

OVERVIEW

The United States Army, Alaska (Army); United States Environmental Protection Agency; and Alaska Department of Environmental Conservation, collectively referred to as *the Agencies*, distributed a Proposed Plan for remedial action at Operable Unit 2 (OU-2), Fort Wainwright, Alaska. OU-2 comprises eight source areas: the Defense Reutilization and Marketing Office (DRMO) Yard, the Building 1168 Leach Well, the North Post Site, the 801 Drum Burial Site, the Engineers Park Drum Site, the Drum Site South of the Landfill, Building 3477, and the Tar Sites.

The Proposed Plan identified preferred remedial alternatives for two of the eight source areas within OU-2: the DRMO Yard and Building 1168 Leach Well. The other six source areas were not considered for remedial action in the Proposed Plan. The soil contamination at the North Post Site consists of petroleum and petroleum-related products and will be addressed through an Army removal action that includes excavation, treatment, and proper disposal of the remediated soil. The 801 Drum Burial Site, Engineers Park Drum Site, and Drum Site South of the Landfill were assigned to Fort Wainwright OU-1 for a more comprehensive investigation and will addressed through that OU's decision process. Finally, no further action is recommended for Building 3477 and the Tar Sites.

The major components of the remedial alternatives for the DRMO Yard are:

- Soil vapor extraction,
- Groundwater air sparging with natural attenuation, and
- Groundwater monitoring/evaluation.

The major components of the remedial alternatives for the Building 1168 Leach Well are:

- Soil vapor extraction,
- Groundwater air sparging with natural attenuation, and
- Groundwater monitoring/evaluation.

No formal comments regarding the Proposed Plan for the OU-2 remedial action were submitted during the public comment period.

BACKGROUND OF COMMUNITY INVOLVEMENT

The public was encouraged to participate in the selection of the final remedies for OU-2 during a public comment period from May 1 to May 31, 1996. The *Fort Wainwright Proposed Plan for Remedial Action at Operable Unit 2* presents combinations of options considered by the Agencies to address contamination in soil and groundwater at OU-2. The Proposed Plan was released to the public on May 1, 1996, and copies were sent to all known interested parties, including elected officials and concerned citizens. Informational Fact Sheets dated March and September 1995 and March 1996, which provided information

about the Army's entire cleanup program at Fort Wainwright, were mailed to the addresses on the same mailing list.

The Proposed Plan summarized available information regarding the OU. Additional materials were placed into two information repositories: one at the Noel Wien Library in Fairbanks and the other at the Fort Wainwright Post Library. An Administrative Record, including all items placed in the information repositories and other documents used in the selection of the remedial actions, was established in Building 3023 on Fort Wainwright. The public was welcome to inspect materials available in the Administrative Record and the information repositories during business hours.

Interested citizens were invited to comment on the Proposed Plan and the remedy selection process by mailing comments to the Fort Wainwright project manager, by calling a toll-free telephone number to record a comment, or by attending and commenting at a public meeting on May 8, 1996, at the Carlson Center in Fairbanks.

Basewide community relations activities conducted for Fort Wainwright, which includes OU-2, have included:

- July 1992—Community interviews with local officials and interested parties;
- April 1993—Preparation of the Community Relations Plan;
- July 1993—Distribution of an informational Fact Sheet covering all OUs at Fort Wainwright;
- July 22, 1993—An informational public meeting covering all OUs;
- April 22, 1994—Establishment of information repositories at the Noel Wien Library and the Fort Wainwright Post Library and at the Administrative Record at Building 3023 on Fort Wainwright;
- March 1995—Distribution of an informational Fact Sheet covering all OUs at Fort Wainwright;
- September 1995—Distribution of an informational Fact Sheet covering all OUs at Fort Wainwright; and
- March 1996—Distribution of an informational Fact Sheet covering all OUs at Fort Wainwright.

Community relations activities conducted specifically for OU-2 included:

- April 28 and May 1, 5, 6, 7, and 8, 1996—Display advertisement announcing the public meeting in the *Fairbanks Daily News-Miner*;
- May 1, 1996—Distribution of the Proposed Plan for final remedial action at OU-2;

- May 1 to May 31, 1996—Thirty-day public comment period. No extension was requested;

- May 1 to May 31, 1996—Toll-free telephone number for citizens to provide comments during the public comment period. The toll-free telephone number was advertised in the Proposed Plan and the newspaper display advertisement that announced the public meeting; and

- May 8, 1996—Public meeting at the Carlson Center to provide information, a forum for questions and answers, and an opportunity for public comment regarding OU-2.

SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD

No comments were received during the public comment period.

APPENDIX D

FORT WAINWRIGHT
OPERABLE UNIT 2 SOURCE AREA
BASELINE COST ESTIMATES
FOR REMEDIAL ALTERNATIVES

BUILDING 1168 SOURCE AREA

BASELINE COST SUMMARY

Fort Wainwright OU-2 Feasibility Study
Building 1168 Baseline Cost Estimate Summary

Component	Remedial Action Alternative				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Present Worth of GW Monitoring	$0	$81,000	$29,000	$29,000	$29,000
Present Worth of Capital Costs*	$0	$49,000	$174,000	$452,000	$350,000
Present Worth of AOC	$0	$0	$66,000	$78,000	$119,000
Total Cost to Implement	**$0**	**$130,000**	**$269,000**	**$559,000**	**$498,000**

* Includes Direct and Indirect Capital Costs.

GW: groundwater

AOC: annual operating cost

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - Building 1168 - Alternative No. 1
No Action

Direct Capital Cost - Detail

	Item	Year of DC Expenditure	Quantity	Rate	Unit	Total
Sparge/Biosparge Wells	Well installation (50-foot, 1 1/4" diameter, direct push, screen wells)	NA	0	1,446.95	ea	10.00
	Trenching to fan house (50', 2' deep- average for each well, incl. backfill)		0	120.25	ea	10.00
	Manhole with cover (one per well)		0	646.50	ea	10.00
	Piping to fanhouse (50' average for each well) with pipe insulation and heat trace		0	850.15	ea	10.00
	Valves and fittings for each run of piping		0	150.00	ea	10.00
	Biosparge treatability test		0	10,000.00	ea	10.00
SVE/Biovent Wells	Well installation (20-foot, 4" diameter, PVC, auger rig installed wells)	NA	0	2,200.00	ea	10.00
	Trenching to fan house (50', 2' deep- average for each well, incl. backfill)		0	120.25	ea	10.00
	Manhole with cover (one per well)		0	646.50	ea	10.00
	Piping to fanhouse (50' average for each well) with pipe insulation and heat trace		0	850.15	ea	10.00
	Valves and fittings for each run of piping		0	150.00	LS	10.00
	Asphalt surface cover to minimize short-circuiting and protect piping from traffic		0	8.47	SY	10.00
	Biovent treatability test		0	10,000.00	LS	10.00
SVE/Sparge Fan House	Prefab housing	NA	0	5,000.00	ea	10.00
	Injection blower		0	9,051.00	ea	10.00
	Water separator		0	1,293.00	ea	10.00
	Mist eliminator		0	1,293.00	ea	10.00
	Duct heater		0	2,133.45	ea	10.00
	Extraction blower		0	9,051.00	ea	10.00
	Condensate receiver		0	1,293.00	ea	10.00
	Unit heater		0	523.87	ea	10.00
	Door louver with bird screen		0	27.80	ea	10.00
	Exhaust Controls		0	10,344.00	ea	10.00
	Instrumentation (pressure, flow)		0	4,848.75	LS	10.00
	Sampling ports		0	387.80	LS	10.00
	Plumbing and electrical hook-up		0	1,000.00	ea	10.00
	Equipment controls		0	2,876.93	ea	10.00
	Item 2:		0	1,000.00	ea	10.00
	Item 3:		0	200.42	ea	10.00
LTTD Treatment	LTTD processing (expanded volume)	NA	0	96.98	CY	10.00
	Excavation (in-place volume)		0	2.55	CY	10.00
	Hauling excavation to/from treatment facility (expanded volume)		0	5.25	CY	10.00
	Confirmatory soil sample analysis- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	10.00
	Treatability testing		0	5,000.00	LS	10.00
	Backfill treated soil in original excavation (expanded volume)		0	2.57	CY	10.00
	Disposal of treated soil at FW landfill (expanded volume)		0	0.00	CY	10.00
	Import & backfill clean fill in place of treated soils at FW landfill (expanded volume)		0	2.99	CY	10.00
Capping	Cap material	NA	0	1.19	SF	10.00
Solidification (portland cement)	Mix design/treatability testing		0	45,000.00	LS	10.00
	Excavation (in-place volume)		0	2.55	CY	10.00
	Mixing, placing		0	193.95	CY	10.00
	Confirmatory soil sample analysis- excavation (rush, 1 sample/200 CY excavated)		0	600.00	ea	10.00
Engineered Pile- Biopile	Excavation (in-place volume)	NA	0	2.55	CY	10.00
	Construction and treatment		0	32.33	CY	10.00
	Treatability testing		0	10,000.00	LS	10.00
	Confirmatory soil sample analysis- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	10.00
Engineered Pile- SVE Pile	Excavation (in-place volume)	NA	0	2.55	CY	10.00
	Construction and treatment		0	32.33	CY	10.00
	Offgas treatment unit		0	10,344.00	LS	10.00
	Treatability testing		0	5,000.00	LS	10.00
	Confirmatory soil sample analysis- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	10.00
Landfarming	Excavation (in-place volume)	NA	0	2.55	CY	10.00
	Construction and treatment		0	9.70	CY	10.00
	Treatability testing		0	5,000.00	LS	10.00
	Confirmatory soil sample analysis- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	10.00
Monitoring Well Installation	Well installation and development (25 foot, 4" diameter, PVC, auger rig installed wells)	NA	0	2,950.00	ea	10.00
Excavation Shoring	Shoring installation and removal in water to depth of 19 feet	NA	0	27.80	LF	10.00
Fencing and Sign Posting	6-foot chain link with high-visibility signs	NA	0	16.47	LF	10.00
Premium for Winter Excavation	Premium for winter excavation (building 1168 low-water in winter)	NA	0	2.55	CY	10.00
Decommissioning at Implementation	Monitor well	NA	0	160.00	ea	10.00
	Permanently installed probe		0	80.00	ea	10.00
Dispose Hot Spot Soil at Fort Wainwright Landfill	Excavation (in-place volume)	NA	0	2.55	CY	10.00
	Hauling excavation to Fort Wainwright Landfill (expanded volume)		0	5.25	CY	10.00
	Disposal (expanded Volume)		0	0.00	CY	10.00
	Confirmatory soil sample analysis- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	10.00
	Import and place clean fill (expanded volume)		0	2.99	CY	10.00
Decommissioning at End of Cleanup Action	Well (monitoring, SVE, air sparge) removal	NA	0	160.00	ea	10.00
	Permanently installed probe removal		0	80.00	ea	10.00
	Underground piping removal, trench backfill, haul and disposal at FW landfill		0	2.00	LF	10.00
	Engineered pile/landfarm deconstruction and stockpiling treated soil		0	10.00	CY	10.00
	Hauling treated soil to placement area		0	5.25	CY	10.00
	Fan house decommissioning and removal		0	1,700.00	ea	10.00
	Site restoration		0		LS	10.00
	Confirmatory soil sample analysis- treated soils (1 sample/200 CY treated soil)		0		ea	10.00
Totals	Year	NA				10.00
	Year	NA				10.00

CY: cubic yard
DC: direct capital cost
ea: each
FW: Fort Wainwright
hr: hour
LF: linear foot
LS: lump sum
LTTD: low temperature thermal desorption
NA: not applicable for this alternative
PVC: polyvinyl chloride
SF: square foot
SY: square yard
SVE: soil vapor extraction

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - Building 1168 - Alternative No. 1
No Action

Indirect Capital Cost Detail

Item		Year of IC Expenditure	Quantity	Rate	Units	Cost	
Engineering: Design to Implementation		NA					
	Administration and supervision		0	85.00	hr	$0	
	Design and development		0	75.00	hr	$0	
	Drafting		0	65.00	hr	$0	
	Monitoring and testing (Year 0)		0	65.00	hr	$0	
	Project engineering		0	65.00	hr	$0	
Subtotal							*$0*
Engineering : Decommissioning		NA					
	Administration and supervision		0	85.00	hr	$0	
	Design and development		0	75.00	hr	$0	
	Drafting		0	65.00	hr	$0	
	Monitoring and testing		0	65.00	hr	$0	
	Project engineering		0	65.00	hr	$0	
Subtotal							*$0*
License/Permit/Legal	(10% engineering costs)	NA	0	0.00	ea	$0	*$0*
Start-up and Shake Down of Treatment System		NA					
	Materials		0	1,000.00	ea	$0	
	Labor		0	65.00	hr	$0	
	Equipment		0	1,000.00	ea	$0	
	Lab Testing		0	500.00	ea	$0	
Subtotal							*$0*
Contingency	(15% capital costs)	NA	1	0.00	LS	$0	*$0*
Total Annual Operating Cost		**NA**					**$0**
	Year	**NA**					**$0**

ea: each

hr: hour

IC: indirect capital cost

NA: not applicable for this alternative

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - Building 1168 - Alternative No.1
No Action

Annual System Operation Cost Detail

Item		Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Total/year
Operating Labor Cost						NA	
(Post-Construction)	Item 1: Groundwater monitoring	0		hr			$0
	Item 2: Training	0		LS			$0
Subtotal							*$0*
Routine Maintenance Materials and Labor Cost						NA	
	Item 1: Groundwater monitoring annual maintenance	0		LS			$0
	Item 2: SVE/air sparge well annual maintenance	0		LS			$0
	Item 3: SVE/ air sparge system annual maintenance	0		LS			$0
Subtotal							*$0*
Auxiliary Materials and Energy						NA	
	Process Chemicals	0		LS			$0
	Electricity	0		LS			$0
	Water	0		LS			$0
	Sewer	0		LS			$0
	Fuel	0		LS			$0
Subtotal							*$0* *$0*
Disposal of Residues						NA	
	Wash water, sludge, etc.	0		LS			$0
Subtotal							*$0*
Purchased Services						NA	
	Professional Services						
	Item 1: Laboratory Fees	0		LS			$0
	Item 2:	0		LS			$0
	Item 3:	0		LS			$0
Subtotal							*$0*
Other:						NA	
Administrative costs not included in other line items		0		LS			$0
Insurance (1% of capital costs prorated for each year of treatment)		1	0	LS			$0
Taxes, licensing, permit renewal (1% of capital costs prorated for each of year of treatment)		1	0	LS			$0
Maintenance Reserve Fund (1% of capital costs prorated for each year of treatment)		1	0	LS			
Subtotal							*$0*
Total Annual Operating Cost							**$0**

Number of years of implementation: 0

AOC: annual operating cost
hr: hour
LS: lump sum
NA: not applicable for this alternative
SVE: soil vapor extraction
IC: indirect capital cost

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - Building 1168 - Alternative No.2
Institutional Controls

Direct Capital Cost - Detail

Item		Year of DC Expenditure	Quantity	Rate	Unit	Total
Soarge/Beesparge Wells	Well installation (30 feet, 1 1/4" diameter, black iron, driven wells)	NA	0	1,486.95	ea	$0.00
	Trenching to run hoses (50', 2' deep average for each well, incl. backfill)		0	120.75	ea	$0.00
	Manhole work (one / one per well)		0	646.50	ea	$0.00
	Piping to transverse 50' average for each well) with pipe insulation and heat trace		0	850.15	ea	$0.00
	Valves and fittings for each run of piping		0	150.00	ea	$0.00
	Beesparge treatability test		0	10,000.00	ea	$0.00
SVE/Bievent Wells	Well installation (25 feet, 4" diameter, PVC, auger rig-installed wells)	NA	0	2,200.00	ea	$0.00
	Trenching to run hoses (50', 2' deep average for each well, incl. backfill)		0	120.75	ea	$0.00
	Manhole work (one / one per well)		0	646.50	ea	$0.00
	Piping to transverse 50' average for each well) with pipe insulation and heat trace		0	850.15	ea	$0.00
	Valves and fittings for each run of piping		0	150.00	LS	$0.00
	Asphalt surface cover to minimize short-circuiting and protect piping from traffic		0	8.47	SY	$0.00
	Bievent treatability test		0	10,000.00	LS	$0.00
SVE/Soarge Fan House	Prefab housing	NA	0	5,000.00	ea	$0.00
	Injection blower		0	9,051.00	ea	$0.00
	Water separator		0	1,293.00	ea	$0.00
	Mist eliminator		0	1,293.00	ea	$0.00
	Duct heater		0	2,133.45	ea	$0.00
	Extraction blower		0	9,051.00	ea	$0.00
	Condensate receiver		0	1,293.00	ea	$0.00
	Unit heater		0	522.67	ea	$0.00
	Door louver vent and screen		0	27.80	ea	$0.00
	Exhaust Controls		0	10,344.00	ea	$0.00
	Instrumentation (pressure, flow)		0	4,848.75	LS	$0.00
	Sampling ports		0	387.90	LS	$0.00
	Plumbing and electrical hook-up		0	1,000.00	ea	$0.00
	Equipment controls		0	2,878.82	ea	$0.00
	Electrical hook-up		0	1,000.00	ea	$0.00
	Lighting		0	200.42	ea	$0.00
LTTD Treatment	LTTD processing (expanded volume)	NA	0	96.98	CY	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Hauling (excavation to from treatment facility (expanded volume)		0	5.25	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Backfill treated soil in original excavation (expanded volume)		0	2.57	CY	$0.00
	Dispose of treated soil at FW landfill (expanded volume)		0	0.00	CY	$0.00
	Import & backfill clean fill if dispose of treated soils at FW landfill (expanded volume)		0	2.99	CY	$0.00
Capping	Cap install	NA	0	1.19	SF	$0.00
Solidification (portland cement)	Mix design treatability testing		0	45,000.00	LS	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Mixing, placing		0	193.95	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	600.00	ea	$0.00
Engineered Pile- Bespoe	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Treatability testing		0	10,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Engineered Pile- SVE Pile	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Offgas treatment unit		0	10,344.00	LS	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Landfarming	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	9.70	CY	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated		0	300.00	ea	$0.00
Monitoring Well Installation	Well installation and development (25-feet, 4" diameter, PVC, auger rig-installed wells	0	7	2,950.00	ea	$5,900.00
Excavation Shoring	Shoring (installation and removal in water to depth of 19 feet	NA	0	27.80	LF	$0.00
Fencing and Sign Posting	6-foot chain link with high-visibility signs	NA	0	16.47	LF	$0.00
Premium for Winter Excavation	Premium for winter excavation (Building 1168 low-water in winter)	NA	0	2.55	CY	$0.00
Decommissioning with	Monitor wells	0	9	220.00	ea	$1,980.00
Implementation	Permeameter installed probe		35	110.00	ea	$3,850.00
Dispose Hot-spot Soil at	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
Fort Wainwright Landfill	Hauling excavation to Fort Wainwright Landfill (expanded volume)		0	5.25	CY	$0.00
	Disposal (expanded volume)		0	0.00	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
	Import and place clean fill (expanded volume)		0	2.99	CY	$0.00
Decommissioning at End of	Well (monitoring, SVE, for sparge) removal		4	220.00	ea	$880.00
Cleanup Action	Permeameter installed probe removal		6	110.00	ea	$660.00
	Underground piping removal, trench backfill, haul and dispose at FW landfill		110	2.00	LF	$220.00
	Well (monitoring)	30	4	220.00	ea	$880.00
	Engineered pile/landfarm deconstruction and stockpiling treated soil		0	10.00	CY	$0.00
	Hauling treated soil to placement area		0	5.25	CY	$0.00
	Fan house decommissioning and removal		1	1,700.00	ea	$1,700.00
	Site restoration		0		LS	$0.00
	Confirmatory soil sample analytical- treated soils (1 sample/200 CY treated soil)		0		ea	$0.00
Totals	Year	0				$16,198.68
	Year	30				$888.00

CY: cubic yard
DC: direct capital cost
ea: each
FW: Fort Wainwright
hr: hour
LF: linear feet
LS: lump sum
LTTD: low temperature thermal desorption
NA: not applicable for this alternative
PVC: polyvinyl chloride
SF: square feet
SY: square yard
SVE: soil vapor extraction

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - Building 1168 - Alternative No.2
Institutional Controls

Indirect Capital Cost Detail

Item		Year of IC Expenditure	Quantity	Rate	Units	Cost	
Engineering: Design to Implementation		0					
	Administration and supervision		80	85.00	hr	$6,800	
	Design and development		80	75.00	hr	$6,000	
	Drafting		48	65.00	hr	$3,120	
	Monitoring and testing (Year 0)		0	0.00	ea	$0	
	Project engineering		80	65.00	hr	$5,200	
Subtotal							*$21,120*
Engineering : Decommissioning		30					
	Administration and supervision		8	85.00	hr	$680	
	Design and development		16	75.00	hr	$1,200	
	Drafting		24	65.00	hr	$1,560	
	Monitoring and testing		0	65.00	hr	$0	
	Project engineering		80	65.00	hr	$5,200	
Subtotal							*$8,640*
License/Permit/Legal	(10% engineering costs)	0	1	2,976.00	ea	$2,976	*$2,976*
Start-up and Shake Down of Treatment System		NA					
	Materials		0	1,000.00	ea	$0	
	Labor		0	65.00	hr	$0	
	Equipment		0	1,000.00	ea	$0	
	Lab Testing		0	500.00	ea	$0	
Subtotal							*$0*
Contingency	(15% capital costs)	0	1	7,320.90	LS	$7,321	*$7,321*
Total	**Year**	**0**					**$31,417**
	Year	**30**					**$8,640**

ea: each

hr: hour

IC: indirect capital cost

LS: lump sum

NA: not applicable for this alternative

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - Building 1168 - Alternative No.2
Institutional Controls

Annual System Operation Cost Detail

Item			Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Total/year
Operating Labor Cost						1/Year		
(Post-Construction)	Item 1: Groundwater monitoring		20	65.00	hr		1 to 30	$1,300
	Item 2: Training		1	200.00	LS		1 to 30	$200
Subtotal								*$1,500*
Routine Maintenance Materials and Labor Cost						1/Year		
	Item 1: Groundwater monitoring annual maintenance		1	500.00	LS		1 to 30	$500
	Item 2: SVE/air sparge well annual maintenance		0		LS			$0
	Item 3: Sampling field kit		2	75.00	day		1 to 30	$150
Subtotal								*$650*
Auxiliary Materials and Energy							NA	
	Process Chemicals		0		LS			$0
	Electricity		0		LS			$0
	Water		0		LS			$0
	Sewer		0		LS			$0
	Fuel		0		LS			$0
Subtotal								*$0*
Disposal of Residues						1/Year		
	Wash water, sludge, ect.		1	500.00	LS		1 to 30	$500
Subtotal								*$500*
Purchased Services						1/Year		
	Professional Services							
		Item 1: Laboratory Fees	4	625.00	well		1 to 30	$2,500
		Item 2:	0		LS			$0
		Item 3:	0		LS			$0
Subtotal								*$2,500*
Other:						1/Year		
Administrative costs not included in other line items			0		LS			$0
Insurance			0	0.00	LS			$0
Taxes, licensing, permit renewal			0	0.00	LS			$0
Maintenance Reserve Fund								
(5% of capital costs prorated for each year of implementation)			1	93.54	LS		1 to 30	$94
Subtotal								*$94*
Total Annual Operating Cost							**1 to 30**	**$5,244**

Number of years of implementation: 30

AOC: annual operating cost
hr: hour
LS: lump sum
NA: not applicable for this alternative
SVE: soil vapor extraction

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - Building 1168 - Alternative No. 3
Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

Direct Capital Cost - Detail

Item		Year of DC Expenditure	Quantity	Rate	Unit	Total
Sparge/biosparge Wells	Well installation (50 feet, 1 1/4" diameter, black iron, driven wells)	0	4	1,486.95	ea	$5,947.80
	Trenching to fan house (50', 2' deep- average for each well, excl. backfill)		4	120.25	ea	$481.00
	Manhole with cover (one per well)		4	646.50	ea	$2,586.00
	Piping to farmhouse (50' average for each well) with pipe insulation and heat trace		4	850.15	ea	$3,400.60
	Valves and fittings for each run of piping		4	150.00	ea	$600.00
	Biosparge treatability test		0	10,000.00	ea	$0.00
SVE Biovent wells	Well installation (20-foot, 4" diameter, PVC, auger rig-installed wells)	0	1	2,200.00	ea	$2,200.00
	Trenching to fan house (50', 2' deep- average for each well, excl. backfill)		1	120.25	ea	$120.25
	Manhole with cover (one per well)		1	646.50	ea	$646.50
	Piping to farmhouse (50' average for each well) with pipe insulation and heat trace		1	850.15	ea	$850.15
	Valves and fittings for each run of piping		1	150.00	LS	$150.00
	Asphalt surface cover to minimize short-circuiting and protect piping from traffic		0	8.47	SY	$0.00
	Biovent treatability test		0	10,000.00	LS	$0.00
SVE Sparge Fan House	Prefab housing	0	0	5,000.00	ea	$0.00
	Injection blower		1	9,051.00	ea	$9,051.00
	Water separator		0	1,293.00	ea	$0.00
	Mist eliminator		1	1,293.00	ea	$1,293.00
	Duct heater		0	2,133.45	ea	$0.00
	Extraction blower		1	9,051.00	ea	$9,051.00
	Condensate receiver		1	1,293.00	ea	$1,293.00
	Unit heater		0	523.87	ea	$0.00
	Door louver with bird screen		0	27.80	ea	$0.00
	Exhaust Controls		1	10,344.00	ea	$10,344.00
	Instrumentation (pressure, flow)		1	4,848.75	LS	$4,848.75
	Sampling ports		1	387.90	LS	$387.90
	Plumbing and electrical hook-up		1	1,000.00	ea	$1,000.00
	Equipment controls		1	2,876.93	ea	$2,876.93
	Electrical hook-up		0	1,000.00	ea	$0.00
	Lighting		0	200.42	ea	$0.00
LTTD Treatment	LTTD processing (expanded volume)	NA	0	96.98	CY	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Hauling excavation to/from treatment facility (expanded volume)		0	5.25	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Backfill treated soil in original excavation (expanded volume)		0	2.57	CY	$0.00
	Dispose of treated soil at FW landfill (expanded volume)		0	0.00	CY	$0.00
	Import & backfill clean fill if dispose of treated soils at FW landfill (expanded volume)		0	2.99	CY	$0.00
Cleanup	Cap install	NA	0	1.19	SF	$0.00
Solidification (portland cement)	Mix design/treatability testing		0	45,000.00	LS	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Mixing, placing		0	193.95	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	600.00	ea	$0.00
Engineered Pile- Biosparge	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Treatability testing		0	10,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Engineered Pile- SVE Pile	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Offgas treatment unit		0	10,344.00	LS	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Landfarming	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	9.70	CY	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Monitoring well installation	Well installation and development (25-feet, 4" diameter, PVC, auger rig-installed wells)	0	2	2,950.00	ea	$5,900.00
Excavation Shoring	Shoring installation and removal in winter to depth of 19 feet	NA	0	27.80	LF	$0.00
Fencing and Sign Posting	6-foot chain link with high-visibility signs	NA	0	16.47	LF	$0.00
Premium for Winter Excavation	Premium for winter excavation (Building 1168 low water in winter)	NA	0	2.55	CY	$0.00
Decommissioning of Unneeded Items	Monitor well	0	8	220.00	ea	$1,760.00
	Permanently installed probe		35	110.00	ea	$3,850.00
Dispose Not upon Site at Fort Wainwright Landfill	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Hauling excavation to Fort Wainwright Landfill (expanded volume)		0	5.25	CY	$0.00
	Disposal (expanded Volume)		0	0.00	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
	Import and place clean fill (expanded volume)		0	2.99	CY	$0.00
Decommissioning at End of Cleanup Action	Well (SVE, air sparge) removal	3	10	220.00	ea	$2,200.00
	Well (monitoring) removal	10	4	220.00	ea	$889.00
	Permanently installed probe removal		0	110.00	ea	$0.00
	Underground piping removal, trench backfill, haul and dispose at FW landfill	3	500	2.00	LF	$1,000.00
	Engineered pile/landfarm deconstruction and stockpiling treated soil		0	10.00	CY	$0.00
	Hauling treated soil to placement area		0	5.25	CY	$0.00
	Fan house decommissioning and removal	3	1	1,700.00	ea	$1,700.00
	Site restoration	3	1	10,000.00	LS	$10,000.00
	Confirmatory soil sample analytical- treated soils (1 sample/200 CY treated soil)	3	5	620.00	ea	$3,100.00
Totals	Year	0				$68,837.69
	Year	3				$18,868.00
	Year	10				$889.00

CY: cubic yard
DC: direct capital cost
ea: each
FW: Fort Wainwright
hr: hour
LF: linear foot
LS: lump sum
LTTD: low temperature thermal desorption
NA: not applicable for this alternative
PVC: polyvinyl chloride
SF: square foot
SY: square yard
SVE: soil vapor extraction

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - Building 1168 - Alternative No. 3
Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

Indirect Capital Cost Detail

Item		Year of IC Expenditure	Quantity	Rate	Units	Cost	
Engineering: Design to Implementation		0					
	Administration and supervision		80	85.00	hr	$6,800	
	Design and development		240	75.00	hr	$18,000	
	Drafting		144	65.00	hr	$9,360	
	Monitoring and testing (Year 0)		0	0.00	ea	$0	
	Project engineering		240	65.00	hr	$15,600	
Subtotal							*$49,760*
Engineering : Decommissioning		3					
	Administration and supervision		16	85.00	hr	$1,360	
	Design and development		20	75.00	hr	$1,500	
	Drafting		24	65.00	hr	$1,560	
	Monitoring and testing		0	65.00	hr	$0	
	Project engineering		40	65.00	hr	$2,600	
Subtotal							*$7,020*
License/Permit/Legal	(10% engineering costs)	0	1	5,678.00	ea	$5,678	*$5,678*
Start-up and Shake Down of Treatment System		0					
	Materials		1	100.00	ea	$100	
	Labor		40	65.00	hr	$2,600	
	Equipment		1	100.00	ea	$100	
	Lab Testing		4	500.00	ea	$2,000	
Subtotal							*$4,800*
Contingency	(15% capital costs)	0	1	23,216.38	LS	$23,216	*$23,216*
Total	**Year**	**0**					**$83,454**
	Year	**3**					**$7,020**

ea: each

hr: hour

IC: indirect capital cost

LS: lump sum

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - Building 1168 - Alternative No.3
Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

Annual System Operation Cost Detail

Item		Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Total/year
Operating Labor Cost					1/year		
(Post-Construction)	Item 1: Groundwater monitoring	12	65.00	hr		1 to 10	$780
	Item 2: SVE/AS system monitoring	52	65.00	hr		1 to 3	$3,380
	Item 3: Training	1	400.00	LS		1 to 10	$400
Subtotal						*1 to 10*	*$1,180*
						1 to 3	*$3,380*
Routine Maintenance Materials and Labor Cost					1/year		
Item 1: Groundwater monitoring annual maintenance		1	500.00	LS		1 to 10	$500
Item 2: SVE/air sparge system annual maintenance		1	500.00	LS		1 to 3	$500
Item 3: Sampling field kit		1	75.00	day		1 to 10	$75
Subtotal						*1 to 10*	*$575*
						1 to 3	*$500*
Auxiliary Materials and Energy					1/year		
	Process Chemicals	0		LS			$0
	Electricity (Phase 1)	1	14,200.00	LS		1 to 3	$14,200
	Electricity (Phase 2)	0	0.00	LS			$0
	Water	0		LS			$0
	Sewer	0		LS			$0
	Fuel	1	200.00	LS		1 to 10	$200
Subtotal						*1 to 10*	*$200*
						1 to 3	*$14,200*
Disposal of Residues					1/year		
	Wash water, sludge, ect.	1	500.00	LS		1 to 10	$500
Subtotal						*1 to 10*	*$500*
Purchased Services					1/year	1 to 10	
Professional Services							
	Item 1: Laboratory Fees	4	625.00	well			$2,500
	Item 2: Engineer review/ consultation	2	65.00	month			$130
	Item 3:	0		LS			$0
Subtotal						*1 to 10*	*$2,630*
Other:					1/year	1 to 10	
Administrative costs not included in other line items		0		LS			$0
Insurance		0		LS			$0
Taxes, licensing, permit renewal		0		LS			$0
Maintenance Reserve Fund							
(5% of capital costs prorated for each year of implementation)		1	889.96	LS			$890
Subtotal						*1 to 10*	*$890*
Total Annual Operating Cost (includes GW Monitoring)						**1 to 3**	**$24,055**
						4 to 10	**$5,975**
Groundwater Monitoring Portion of Total AOC						*1 to 10*	*$3,780*

Number of years of implementation: 10

AOC: annual operating cost
AS: air sparge
hr: hour
LS: lump sum
SVE: soil vapor extraction
GW: groundwater

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - Building 1168 - Alternative No. 4
Alternative 3 Plus Excavation and LTTD of Contaminated Unsaturated Soil

Direct Capital Cost - Detail

Item		Year of OC Expenditure	Quantity	Rate	Unit	Total
Sparge biosparge wells	Well installation 50-foot, 1 1/4" diameter, black iron, driven wells)	0	4	1,486.95	ea	$5,947.80
	Trenching to fan house (50', 2' deep- average for each well, incl. backfill)		4	120.25	ea	$481.00
	Manhole with cover (one per well)		4	646.50	ea	$2,586.00
	Piping to fanhouse (50' average for each well) with pipe insulation and heat trace		4	850.15	ea	$3,400.60
	Valves and fittings for each run of piping		4	150.00	ea	$600.00
	Biosparge treatability test		1	10,000.00	ea	$10,000.00
SVE/Biovent wells	Well installation (20 foot, 4" diameter, PVC, auger rig-installed wells)	0	1	2,200.00	ea	$2,200.00
	Trenching to fan house (50', 2' deep- average for each well, incl. backfill)		1	120.25	ea	$120.25
	Manhole with cover (one per well)		1	646.50	ea	$646.50
	Piping to fanhouse (50' average for each well) with pipe insulation and heat trace		1	950.15	ea	$950.15
	Valves and fittings for each run of piping		1	150.00	LS	$150.00
	Asphalt surface cover to minimize short-circuiting and protect piping from traffic		0	8.47	SY	$0.00
	Biovent treatability test		1	10,000.00	LS	$10,000.00
SVE/Sparge Fan House	Prefab housing	0	0	5,000.00	ea	$0.00
	Injection blower		1	9,051.00	ea	$9,051.00
	Water separator		0	1,293.00	ea	$0.00
	Mist eliminator		1	1,293.00	ea	$1,293.00
	Duct heater		0	2,133.45	ea	$0.00
	Extraction blower		1	9,051.00	ea	$9,051.00
	Condensate receiver		1	1,293.00	ea	$1,293.00
	Unit heater		0	523.67	ea	$0.00
	Door louver with bird screen		0	27.00	ea	$0.00
	Exhaust Controls		1	10,344.00	ea	$10,344.00
	Instrumentation (pressure, flow)		1	4,848.75	LS	$4,848.75
	Sampling ports		1	387.90	LS	$387.90
	Plumbing and electrical hook-up		1	1,000.00	ea	$1,000.00
	Equipment controls		1	2,876.93	ea	$2,876.93
	Electrical hook-up		0	1,000.00	ea	$0.00
	Lighting		0	200.42	ea	$0.00
LTTD Treatment	LTTD processing (expanded volume)	NA	1560	96.98	CY	$151,288.80
	Excavation (in-place volume)		5700	2.55	CY	$14,535.00
	Hauling excavation to/from treatment facility (expanded volume)		1560	5.25	CY	$8,190.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		29	300.00	ea	$8,700.00
	Treatability testing		1	5,000.00	LS	$5,000.00
	Backfill treated soil in original excavation (expanded volume)		0	2.57	CY	$0.00
	Backfill excavated clean overburden		4400	1.99	CY	$8,756.00
	Dispose of treated soil at FW landfill (expanded volume)		1560	0.00	CY	$0.00
	Import & backfill clean fill if dispose of treated soils at FW landfill (expanded volume)		1560	2.99	CY	$4,664.40
Capping	Cap system	NA	0	1.13	SF	$0.00
Solidification (portland cement)	Mix design/treatability testing		0	45,000.00	LS	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Mixing, placing		0	183.95	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	600.00	ea	$0.00
Engineered Pile- Biopile	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Treatability testing		0	10,008.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Engineered Pile- SVE Pile	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Offgas treatment unit		0	10,344.00	LS	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated		0	300.00	ea	$0.00
Landfarming	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	9.70	CY	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated		0	300.00	ea	$0.00
Monitoring well installation	Well installation and development (25-foot, 4" diameter, PVC, auger rig-installed wells)	0	2	2,950.00	ea	$5,900.00
Excavation Shoring	Shoring installation and removal in winter to depth of 19 feet	3	320	27.80	LF	$8,896.00
Fencing and Sign Posting	6-foot chain link with high-visibility signs	NA	0	16.47	LF	$0.00
Premium for Winter Excavation	Premium for winter excavation (Building 1168 low-winter is winter)	3	5700	2.55	CY	$14,535.00
Decommissioning at implementation	Monitor well	0	8	220.00	ea	$1,760.00
	Permanently installed probe		35	110.00	ea	$3,850.00
Dispose non-spent Soil at Fort Wainwright Landfill	Excavation (in-place volume)	0	0	2.55	CY	$0.00
	Hauling excavation to Fort Wainwright Landfill (expanded volume)		0	5.25	CY	$0.00
	Disposal (expanded Volume)		0	8.00	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
	Import and place clean fill (expanded volume)		0	2.99	CY	$0.00
Decommissioning at End of Cleanup Action	Well (SVE, air sparge) removal	3	10	220.00	ea	$2,200.00
	Well (monitoring) removal	10	4	220.00	ea	$880.00
	Permanently installed probe removal		0	110.00	ea	$0.00
	Underground piping removal, trench backfill, haul and dispose at FW landfill	3	500	2.00	LF	$1,000.00
	Engineered pile/landfarm deconstruction and stockpiling treated soil		0	10.00	CY	$0.00
	Hauling treated soil to placement area		0	5.25	CY	$0.00
	Fan house decommissioning and removal	3	1	1,700.00	ea	$1,700.00
	Site restoration	3	1	10,000.00	LS	$10,000.00
	Confirmatory soil sample analytical	3	5	620.00	ea	$3,100.00
Totals	Year	0				$88,637.88
	Year	3				$242,568.20
	Year	10				$880.00

CY: cubic yard
OC: direct capital cost
ea: each
FW: Fort Wainwright
hr: hour
LF: linear foot
LS: lump sum
LTTD: low temperature thermal desorption
NA: not applicable for this alternative
PVC: polyvinyl chloride
SF: square foot
SY: square yard
SVE: soil vapor extraction

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - Building 1168 - Alternative No. 4
Alternative 3 Plus Excavation and LTTD of Contaminated Unsaturated Soils

Indirect Capital Cost Detail

Item		Year of IC Expenditure	Quantity	Rate	Units	Cost	
Engineering: Design to Implementation		0					
	Administration and supervision		80	85.00	hr	$6,800	
	Design and development		240	75.00	hr	$18,000	
	Drafting		168	65.00	hr	$10,920	
	Monitoring and testing (Year 0)		0	0.00	ea	$0	
	Project engineering		240	65.00	hr	$15,600	
Subtotal							*$51,320*
Engineering : Decommissioning		3					
	Administration and supervision		60	85.00	hr	$5,100	
	Design and development		100	75.00	hr	$7,500	
	Drafting		96	65.00	hr	$6,240	
	Monitoring and testing		0	65.00	hr	$0	
	Project engineering		160	65.00	hr	$10,400	
Subtotal							*$29,240*
License/Permit/Legal	(10% engineering costs)	0	1	8,056.00	ea	$8,056	*$8,056*
Start-up and Shake Down of Treatment System		0					
	Materials		1	100.00	ea	$100	
	Labor		40	65.00	hr	$2,600	
	Equipment		1	100.00	ea	$100	
	Lab Testing		4	500.00	ea	$2,000	
Subtotal							*$4,800*
Contingency	(15% capital costs)	0	1	63,824.86	LS	$63,825	*$63,825*
Total	**Year**	**0**					**$128,001**
	Year	**3**					**$29,240**

ea: each

hr: hour

IC: indirect capital cost

LS: lump sum

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - Building 1168 - Alternative No.4
Alternative 3 Plus Excavation and LTTD of Contaminated Unsaturated Soil

Annual System Operation Cost Detail

Item		Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Total/year
Operating Labor Cost					1/year		
(Post-Construction)	Item 1: Groundwater monitoring	12	65.00	hr		1 to 10	$780
	Item 2: SVE/AS system monitoring	52	65.00	hr		1 to 3	$3,380
	Item 3: Training	1	400.00	LS		1 to 10	$400
Subtotal						*1 to 10*	*$1,180*
						1 to 3	*$3,380*
Auxiliary Materials and Energy					1/year		
	Item 1: Groundwater monitoring annual maintenance	1	500.00	LS		1 to 10	$500
	Item 2: SVE/AS system annual maintainence	1	500.00	LS		1 to 3	$500
	Item 3: Sampling field kit	1	75.00	day		1 to 10	$75
Subtotal						*1 to 10*	*$575*
						1 to 3	*$500*
Auxiliary Materials and Energy					1/year		
	Process Chemicals	0		LS			$0
	Electricity (Phase 1)	1	14,200.00	LS		1 to 3	$14,200
	Electricity (Phase 2)	0		LS			
	Water	0		LS			$0
	Sewer	0		LS			$0
	Fuel	1	200.00	LS		1 to 10	$200
Subtotal						*1 to 10*	*$200*
						1 to 3	*$14,200*
Disposal of Residues					1/year		
	Wash water, sludge, ect.	1	500.00	LS		1 to 10	$500
Subtotal						*1 to 10*	*$500*
Purchased Services					1/year		
Professional Services							
	Item 1: Laboratory Fees	4	625.00	well		1 to 10	$2,500
	Item 2: Engineer review/ consultation	2	65.00	month		1 to 10	$130
	Item 3:	0		LS			$0
Subtotal						*1 to 10*	*$2,630*
Other:					1/year	1 to 10	
Administrative costs not included in other line items		0		LS			$0
Insurance		0		LS			$0
Taxes, licensing, permit renewal		0		LS			$0
Maintenance Reserve Fund							
(5% of capital costs prorated for each year of implementation)		1	2,446.62	LS			$2,447
Subtotal						*1 to 10*	*$2,447*
Total Annual Operating Cost (includes GW Monitoring)						**1 to 3**	**$25,612**
						4 to 10	**$7,532**
Groundwater Monitoring Portion of Total AOC						*1 to 10*	*$3,780*

Number of years of implementation: 10

AOC: annual operating cost
AS: air sparge
ea: each
hr: hour
SVE: soil vapor extraction
GW: groundwater

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - Building 1168 - Alternative No. 5
Alternative 3 Plus Excavation and Engineered Pile Treatment (biopile or vapor extraction pile) of Contaminated Soil

Direct Capital Cost - Detail

Item		Yr of DC Expenditure	Quantity	Cost	Unit	Total
Sparge biosparge wells	Well installation (50-foot, 1 1/4" diameter, black iron, drilled wells)	3	4	1,486.95	ea	$5,947.80
	Trenching to fan house (50', 2' deep- average for each well, incl. backfill)		4	120.25	ea	$481.00
	Manhole with cover (one per well)		4	646.50	ea	$2,586.00
	Piping to fanhouse (50' average for each well) with pipe insulation and heat trace		4	850.15	ea	$3,400.60
	Valves and fittings for each run of piping		4	150.00	ea	$600.00
	Biosparge treatability test		1	10,000.00	ea	$10,000.00
SVE/Biovent Wells	Well installation (20-foot, 4" diameter, PVC, auger rig-installed wells)	3	1	2,200.00	ea	$2,200.00
	Trenching to fan house (50', 2' deep- average for each well, incl. backfill)		1	120.25	ea	$120.25
	Manhole with cover (one per well)		1	646.50	ea	$646.50
	Piping to fanhouse (50' average for each well) with pipe insulation and heat trace		1	850.15	ea	$850.15
	Valves and fittings for each run of piping		1	150.00	LS	$150.00
	Asphalt surface cover to minimize short-circuiting and protect piping from traffic		0	8.47	SY	$0.00
	Biovent treatability test		1	10,000.00	LS	$10,000.00
SVE/Sparge Fan House	Prefab housing	3	1	5,000.00	ea	$0.00
	Injection blower		1	9,051.00	ea	$9,051.00
	Water separator		0	1,293.00	ea	$0.00
	Mist eliminator		1	1,293.00	ea	$1,293.00
	Duct heater		0	2,133.45	ea	$0.00
	Extraction blower		1	9,051.00	ea	$9,051.00
	Condensate receiver		1	1,293.00	ea	$1,293.00
	Unit heater		0	523.87	ea	$0.00
	Door louver with bird screen		0	27.80	ea	$0.00
	Exhaust Controls		1	10,344.00	ea	$10,344.00
	Instrumentation (pressure, flow)		1	4,848.75	LS	$4,848.75
	Sampling ports		1	387.90	LS	$387.90
	Plumbing and electrical hook-up		1	1,000.00	ea	$1,000.00
	Equipment controls		1	2,876.93	ea	$2,876.93
	Electrical hook-up		0	1,000.00	ea	$0.00
	Lighting		0	200.42	ea	$0.00
LTTD Treatment	LTTD processing (expanded volume)	NA	0	96.98	CY	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Hauling excavation to/from treatment facility (expanded volume)		0	5.25	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Backfill treated soil in original excavation (expanded volume)		0	2.57	CY	$0.00
	Dispose of treated soil at FW landfill (expanded volume)		0	0.00	CY	$0.00
	Import & backfill clean fill if dispose of treated soils at FW landfill (expanded volume)		0	2.99	CY	$0.00
Capping	Cap install	NA	0	1.19	SF	$0.00
Solidification (portland cement)	Mix design/treatability testing	NA	0	45,000.00	LS	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Mixing, placing		0	193.95	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Engineered Pile- Biopile	Excavation (in-place volume)	3	5700	2.55	CY	$14,535.00
	Construction		1568	32.33	CY	$50,434.80
	Import and backfill clean fill if do not keep excavation open for filling after treatment		1568	2.99	CY	$4,684.40
	Backfill excavated clean overburden		4400	1.99	CY	$8,756.00
	Treatability testing		1	10,000.00	LS	$10,000.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		29	300.00	ea	$8,700.00
Engineered Pile- SVE Pile	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Offgas treatment unit		0	10,344.00	LS	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Landfarming	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	9.70	CY	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Monitoring Well Installation	Well installation and development (25 foot, 4" diameter, PVC, auger rig-installed wells)	0	2	2,950.00	ea	$5,900.00
Excavation Shoring	Shoring installation and removal in winter to depth of 19 feet	3	320	27.80	LF	$8,896.00
Fencing and Sign Posting	6-foot chain link with high-visibility signs	NA	0	16.47	LF	$0.00
Premium for Winter Excavation	Premium for winter excavation (building 1168 low water in winter)	3	5700	2.55	CY	$14,535.00
Decommissioning at Implementation	Monitor well	0	8	220.00	ea	$1,760.00
	Permanently installed probe		35	110.00	ea	$3,850.00
Dispose Hot-spot Soil at	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
Fort Wainwright Landfill	Hauling excavation to Fort Wainwright Landfill (expanded volume)		0	5.25	CY	$0.00
	Disposal (expanded Volume)		0	0.00	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
	Import and place clean fill (expanded volume)		0	2.99	CY	$0.00
Decommissioning at End of Cleanup Action	Well (SVE, air sparge) removal	3	10	220.00	ea	$2,200.00
	Well (monitoring) removal	10	4	220.00	ea	$880.00
	Permanently installed probe removal		0	110.00	ea	$0.00
	Underground piping removal, trench backfill, haul and dispose at FW landfill	3	500	2.00	LF	$1,000.00
	Engineered pile/landfarm deconstruction and stockpiling treated soil	5	1	10.00	CY	$10.00
	Hauling treated soil to placement area	5	1	5.25	CY	$5.25
	Fan house decommissioning and removal	3	1	1,700.00	ea	$1,700.00
	Site restoration	5	1	10,000.00	LS	$10,000.00
	Confirmatory soil sample analytical	3	5	620.00	ea	$3,100.00
Totals	Year	0				$10,837.80
	Year	3				$128,821.20
	Year	5				$10,815.25
	Year	10				$880.00

CY: cubic yard
DC: direct capital cost
ea: each
FW: Fort Wainwright
hr: hour
LF: linear foot
LS: lump sum
LTTD: low temperature thermal desorption
NA: not applicable for this alternative
PVC: polyvinyl chloride
SF: square foot
SY: square yard
SVE: soil vapor extraction

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - Building 1168 - Alternative No. 5
Alternative 3 Plus Excavation and Engineered Pile Treatment (biopile or vapor extraction pile) of Contaminated Soil

Indirect Capital Cost Detail

Item		Year of IC Expenditure	Quantity	Rate	Units	Cost	
Engineering: Design to Implementation		0					
	Administration and supervision		80	85.00	hr	$6,800	
	Design and development		240	75.00	hr	$18,000	
	Drafting		168	65.00	hr	$10,920	
	Monitoring and testing (Year 0)		0	0.00	ea	$0	
	Project engineering		240	65.00	hr	$15,600	
Subtotal							*$51,320*
Engineering : Decommissioning		3					
	Administration and supervision		60	85.00	hr	$5,100	
	Design and development		120	75.00	hr	$9,000	
	Drafting		96	65.00	hr	$6,240	
	Monitoring and testing		0	65.00	hr	$0	
	Project engineering		200	65.00	hr	$13,000	
Subtotal						*Year 3*	*$33,340*
License/Permit/Legal	(10% engineering costs)	0	1	8,466.00	ea	$8,466	*$8,466*
Start-up and Shake Down of Treatment System		3					
	Materials		1	200.00	ea	$200	
	Labor		40	65.00	ea	$2,600	
	Equipment		1	200.00	ea	$200	
	Lab Testing		4	500.00	ea	$2,000	
Subtotal							*$5,000*
Contingency	(15% capital costs)	0	1	48,927.05	LS	$48,927	*$48,927*
	Year	0					$108,713
Total	Year	3					$38,340

ea: each

hr: hour

IC: indirect capital cost

LS: lump sum

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - Building 1168 - Alternative No. 5
Alternative 3 Plus Excavation and Engineered Pile Treatment (biopile or vapor extraction pile) of Contaminated Soil

Annual System Operation Cost Detail

Item		Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Total/year
Operating Labor Cost					1/year		
(Post-Construction)	Item 1: Groundwater monitoring	12	65.00	hr		1 to 10	$780
	Item 2: SVE/AS system monitoring	156	65.00	hr		1 to 3	$10,140
	Item 3: engineered pile system monitoring	64	65.00	hr		4 to 5	$4,160
	Item 4: Training	1	400.00	LS		1 to 10	$400
Subtotal						*1 to 10*	*$1,180*
						4 to 5	*$4,160*
						1 to 3	*$10,140*
Auxiliary Materials and Energy					1/year		
	Item 1: Groundwater monitoring annual maintenance	1	500.00	LS		1 to 10	$500
	Item 2: SVE/air sparge system annual maintenance	1	1,500.00	LS		1 to 3	$1,500
	Item 3: engineered pile system maintainence	16	65.00	hr		4 to 5	$1,040
	Item 4: Sampling field kit	1	75.00	day		1 to 10	$75
Subtotal						*1 to 10*	*$575*
						4 to 5	*$1,040*
						1 to 3	*$1,500*
Auxiliary Materials and Energy					1/year		
	Process Chemicals	0		LS			$0
	Electricity (SVE/AS)	1	14,200.00	LS		1 to 3	$14,200
	Electricity (Engineered pile)	1	2,000.00	LS		4 to 5	$2,000
	Water	0		LS			$0
	Sewer	0		LS			$0
	Fuel	1	200.00	LS		1 to 10	$200
Subtotal						*1 to 10*	*$200*
						4 to 5	*$2,000*
						1 to 3	*$14,200*
Disposal of Residues					1/year		
	Wash water, sludge, etc.	1	500.00	LS		1 to 10	$500
Subtotal						*1 to 10*	*$500*
Purchased Services					1/year		
	Item 1: Laboratory Fees (G.W. monitoring)	4	625.00	well		1 to 10	$2,500
	Item 2: Engineer review/ consultation (G.W. treatment)	2	65.00	month		1 to 10	$130
	Item 3: Engineer review/ consultation (engineered pile)	16	65.00	LS		4 to 5	$1,040
	Item 4: Laboratory Fees (engineered pile)	13	500.00	ea		4 to 5	$6,500
Subtotal						*1 to 10*	*$2,630*
						4 to 5	*$7,540*
Other:					1/year	1 to 10	
Administrative costs not included in other line items		0		LS			$0
Insurance		0		LS			$0
Taxes, licensing, permit renewal		0		LS			$0
Maintenance Reserve Fund							
(5% of capital costs prorated for each year of implementation)		1	1,875.54	LS			$1,876
Subtotal						*1 to 10*	*$1,876*
Total Annual Operating Cost (includes GW Monitoring)						**1 to 3**	**$32,801**
						4 to 5	**$21,701**
						6 to 10	**$6,961**
Groundwater Monitoring Portion of Total AOC						*1 to 10*	*$3,780*

Number of years of implementation: 10

AOC: annual operating cost
AS: air sparge
hr: hour
LS: lump sum
SVE: soil vapor extraction
GW: groundwater

DRMO YARD SOURCE AREA

BASELINE COST SUMMARY

Fort Wainwright OU-2 Feasibility Study
DRMO Yard Baseline Estimate Summary

Component	Remedial Action Alternative				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Present Worth of GW Monitoring	$0	$146,000	$89,000	$89,000	$132,000
Present Worth of Capital Costs*	$0	$34,000	$1,426,000	$1,498,000	$2,062,000
Present Worth of AOC	$0	$0	$680,000	$682,000	$698,000
Total Cost to Implement	**$0**	**$180,000**	**$2,195,000**	**$2,269,000**	**$2,892,000**

* Includes Direct and Indirect Capital Costs.

GW: groundwater

AOC: annual operating cost

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - DRMO - Alternative No. 1
No Action

Direct Capital Cost - Detail

Item		Year of DC Expenditure	Quantity	Rate	Unit	Total
Sparge/Biosparge Wells	Well installation (50 feet, 1 1/4" diameter, trace wire, driven wells)	NA	0	1,426.95	ea	$0.00
	Trenching to fan house (50', 2' deep, average for each well, incl. backfill)		0	120.25	ea	$0.00
	Manhole with cover (one per well)		0	646.50	ea	$0.00
	Piping to fanhouse (50' average for each well) with pipe insulation and heat trace		0	850.15	ea	$0.00
	Valves and fittings for each run of piping		0	150.00	ea	$0.00
	Biosparge treatability test		0	10,000.00	ea	$0.00
SVE/Bievent Wells	Well installation (20 feet, 4" diameter, PVC, auger rig-installed wells)	NA	0	2,200.00	ea	$0.00
	Trenching to fan house (50', 2' deep, average for each well, incl. backfill)		0	120.25	ea	$0.00
	Manhole with cover (one per well)		0	646.50	ea	$0.00
	Piping to fanhouse (50' average for each well) with pipe insulation and heat trace		0	850.15	ea	$0.00
	Valves and fittings for each run of piping		0	150.00	LS	$0.00
	Asphalt surface cover to minimize short-circuiting and protect piping from traffic		0	9.47	SY	$0.00
	Bievent treatability test		0	10,000.00	LS	$0.00
SVE/Sparge Fan House	Prefab housing	NA	0	5,000.00	ea	$0.00
	Injection blower		0	9,051.00	ea	$0.00
	Water separator		0	1,293.00	ea	$0.00
	Mist eliminator		0	1,293.00	ea	$0.00
	Duct heater		0	2,133.45	ea	$0.00
	Extraction blower		0	9,051.00	ea	$0.00
	Condensate receiver		0	1,293.00	ea	$0.00
	Unit heater		0	523.87	ea	$0.00
	Door louver with bird screen		0	27.80	ea	$0.00
	Exhaust Controls		0	10,344.00	ea	$0.00
	Instrumentation (pressure, flow)		0	4,848.75	LS	$0.00
	Sampling ports		0	387.90	LS	$0.00
	Plumbing and electrical hook-up		0	1,000.00	ea	$0.00
	Equipment controls		0	2,676.93	ea	$0.00
	Electrical hook-up		0	1,000.00	ea	$0.00
	Lighting		0	200.42	ea	$0.00
LTTD Treatment	LTTD processing (expanded volume)	NA	0	56.98	CY	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Hauling excavation to/from treatment facility (expanded volume)		0	5.25	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Backfill treated soil in original excavation (expanded volume)		0	2.57	CY	$0.00
	Dispose of treated soil at FW landfill (expanded volume)		0	0.00	CY	$0.00
	Import & backfill clean fill if dispose of treated soils at FW landfill (expanded volume)		0	2.99	CY	$0.00
Capping	Cap install	NA	0	1.19	SF	$0.00
Solidification (portland cement)	Mix design/treatability testing		0	35,000.00	LS	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Mixing, placing		0	193.95	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	600.00	ea	$0.00
Engineered Pile- Bauple	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Treatability testing		0	10,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Engineered Pile- SVE Pile	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Offgas treatment unit		0	10,344.00	LS	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Landfarming	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	9.70	CY	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Monitoring Well Installation	Well installation and development (25 feet, 4" diameter, PVC, auger rig-installed wells)	NA	0	2,950.00	ea	$0.00
Excavation Shoring	Shoring installation and removal in winter to depth of 19 feet	NA	0	27.80	LF	$0.00
Fencing and Sign Posting	6-foot chain link with high visibility signs	NA	0	18.47	LF	$0.00
Premium for Winter Excavation	Premium for winter excavation (Building 1168 low-water in winter)	NA	0	2.55	CY	$0.00
Decommissioning at implementation	Monitor well	NA	0	220.00	ea	$0.00
	Permanently installed probe		0	110.00	ea	$0.00
Dispose Hot-spot Soil at Fort Wainwright Landfill	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Hauling excavation to Fort Wainwright Landfill (expanded volume)		0	5.25	CY	$0.00
	Disposal (expanded Volume)		0	0.00	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
	Import and place clean fill (expanded volume)		0	2.99	CY	$0.00
Decommissioning at End of Cleanup Action	Well (monitoring, SVE, air sparge) removal	NA	0	220.00	ea	$0.00
	Permanently installed probe removal		0	110.00	ea	$0.00
	Underground piping removal, trench backfill, haul and dispose at FW landfill		0	2.00	LF	$0.00
	Engineered pile/landfarm deconstruction and stockpiling treated soil		0	10.00	CY	$0.00
	Hauling treated soil to placement area		0	5.25	CY	$0.00
	Fan house decommissioning and removal		0	1,700.00	ea	$0.00
	Site restoration		0		LS	$0.00
	Confirmatory soil sample analytical- treated soils (1 sample/200 CY treated soil)		0		ea	$0.00
Totals	Year	NA				$0.00
	Year	NA				$0.00

CY: cubic yard
DC: direct capital cost
ea: each
FW: Fort Wainwright
hr: hour
LF: linear foot
LS: lump sum
LTTD: low temperature thermal desorption
NA: not applicable for this alternative
PVC: polyvinyl chloride
SF: square foot
SY: square yard
SVE: soil vapor extraction

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - DRMO - Alternative No. 1
No Action

Indirect Capital Cost Detail

Item		Year of IC Expenditure	Quantity	Rate	Units	Cost	
Engineering: Design to Implementation		NA					
	Administration and supervision		0	85.00	hr	$0	
	Design and development		0	75.00	hr	$0	
	Drafting		0	65.00	hr	$0	
	Monitoring and testing (Year 0)		0	65.00	hr	$0	
	Project engineering		0	65.00	hr	$0	
Subtotal							*$0*
Engineering : Decommissioning		NA					
	Administration and supervision		0	85.00	hr	$0	
	Design and development		0	75.00	hr	$0	
	Drafting		0	65.00	hr	$0	
	Monitoring and testing		0	65.00	hr	$0	
	Project engineering		0	65.00	hr	$0	
Subtotal							*$0*
License,Permit/Legal	(10% engineering costs)	NA	0	0.00	ea	$0	*$0*
Start-up and Shake Down of Treatment System		NA					
	Materials		0	1,000.00	ea	$0	
	Labor		0	65.00	hr	$0	
	Equipment		0	1,000.00	ea	$0	
	Lab Testing		0	500.00	ea	$0	
Subtotal							*$0*
Contingency	(15% capital costs)	NA	1	0.00	LS	$0	*$0*
Total Annual Operating Cost	**Year**	NA					**$0**
	Year	NA					**$0**

ea: each

hr: hour

IC: indirect capital cost

NA: not applicable for this alternative

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - DRMO - Alternative No.1
No Action

Annual System Operation Cost Detail

Item		Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Total/year
Operating Labor Cost						NA	
(Post-Construction)	Item 1: Groundwater monitoring	0		hr			$0
	Item 2: Training	0		LS			$0
Subtotal							*$0*
Routine Maintenance Materials and Labor Cost						NA	
	Item 1: Groundwater monitoring annual maintenance	0		LS			$0
	Item 2: SVE/air sparge system annual maintenance	0		LS			$0
	Item 3: Sampling field kit	0		day			$0
Subtotal							*$0*
Auxiliary Materials and Energy						NA	
	Process Chemicals	0		LS			$0
	Electricity (Phase 1)	0		LS			$0
	Electricity (Phase 2)	0		LS			$0
	Water	0		LS			$0
	Sewer	0		LS			$0
	Fuel	0		LS			$0
Subtotal							*$0*
							$0
							$0
Disposal of Residues						NA	
	Wash water, sludge, ect.	0		LS			$0
Subtotal							*$0*
Purchased Services						NA	
Professional Services							
	Item 1: Laboratory Fees	0		LS			$0
	Item 2: Engineer review/ consultation	0		LS			$0
	Item 3:	0		LS			$0
Subtotal							*$0*
Other:						NA	
Administrative costs not included in other line items		0		LS			$0
Insurance		1	0	LS			$0
Taxes, licensing, permit renewal		1	0	LS			$0
Maintenance Reserve Fund							
(5% of capital costs prorated for each year of implementation)		1	0	LS			$0
Subtotal							*$0*
Total Annual Operating Cost							**$0**

Number of years of implementation: 0

AOC: annual operating cost
hr: hour
LS: lump sum
NA: not applicable for this alternative
SVE: soil vapor extraction

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - DRMO - Alternative No. 2
Institutional Controls and Natural Attenuation

Direct Capital Cost - Detail

Item		Year of DC Expenditure	Quantity	Rate	Unit	Total
Sparge/Biosparge Wells	Well installation (50 feet, 1 1/4" diameter, stack-mix, driven wells)	NA	0	1,486.95	ea	$0.00
	Trenching to fan house (50', 2' deep- average for each well, incl. backfill)		0	120.25	ea	$0.00
	Manhole with cover (one per well)		0	848.50	ea	$0.00
	Piping to fanhouse (50' average for each well) with pipe insulation and heat trace		0	850.15	ea	$0.00
	Valves and fittings for each run of piping		0	150.00	ea	$0.00
	Biosparge treatability test		0	10,000.00	ea	$0.00
SVE/Biovent Wells	Well installation (20 feet, 4" diameter, PVC, auger rig-installed wells)	NA	0	2,200.00	ea	$0.00
	Trenching to fan house (50', 2' deep- average for each well, incl. backfill)		0	120.25	ea	$0.00
	Manhole with cover (one per well)		0	848.50	ea	$0.00
	Piping to fanhouse (50' average for each well) with pipe insulation and heat trace		0	850.15	ea	$0.00
	Valves and fittings for each run of piping		0	150.00	LS	$0.00
	Asphalt surface cover to minimize short-circuiting and protect piping from traffic		0	8.47	SY	$0.00
	Biovent treatability test		0	10,000.00	LS	$0.00
SVE/Sparge Fan House	Prefab housing	NA	0	5,000.00	ea	$0.00
	Injection blower		0	9,051.00	ea	$0.00
	Water separator		0	1,293.00	ea	$0.00
	Mist eliminator		0	1,293.00	ea	$0.00
	Duct heater		0	2,133.45	ea	$0.00
	Extraction blower		0	9,051.00	ea	$0.00
	Condensate receiver		0	1,293.00	ea	$0.00
	Unit heater		0	523.67	ea	$0.00
	Door louver with bird screen		0	27.80	ea	$0.00
	Exhaust Controls		0	10,344.00	ea	$0.00
	Instrumentation (pressure, flow)		0	4,848.75	LS	$0.00
	Sampling ports		0	387.80	LS	$0.00
	Plumbing and electrical hook-up		0	1,000.00	ea	$0.00
	Equipment controls		0	2,876.93	ea	$0.00
	Electrical hook-up		0	1,000.00	ea	$0.00
	Lighting		0	200.42	ea	$0.00
LTTD Treatment	LTTD processing (expanded volume)	NA	0	96.98	CY	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Hauling excavation to/from treatment facility (expanded volume)		0	5.25	CY	$0.00
	Confirmatory soil sample analysis- excavation (max. 1 sample/200 CY excavated)		0	300.00	ea	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Backfill treated soil in original excavation (expanded volume)		0	2.57	CY	$0.00
	Dispose of treated soil at FW landfill (expanded volume)		0	0.00	CY	$0.00
	Import & backfill clean fill if disposal of treated soils at FW landfill (expanded volume)		0	2.99	CY	$0.00
Capping	Cap asphalt	NA	0	1.19	SF	$0.00
Solidification (portland cement)	Mix design treatability testing		0	35,000.00	LS	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Mixing, placing		0	193.95	CY	$0.00
	Confirmatory soil sample analysis- excavation (max. 1 sample/200 CY excavated)		0	800.00	ea	$0.00
Engineered Pile: Biopile	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Treatability testing		0	10,000.00	LS	$0.00
	Confirmatory soil sample analysis- excavation (max. 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Engineered Pile: SVE Pile	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Offgas treatment unit		0	10,344.00	LS	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analysis- excavation (max. 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Landfarming	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	9.70	CY	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analysis- excavation (max. 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Monitoring Well Installation	Well installation and development (20-foot, 4" diameter, PVC, auger rig-installed wells)	-	2	2,950.00	ea	$5,900.00
Excavation Shoring	Shoring installation and removal in manner to depth of 19 feet	NA	0	27.80	LF	$0.00
Fencing and Sign Posting	6 foot chain link with high visibility signs	NA	0	16.47	LF	$0.00
Premium for Winter Excavation	Premium for winter excavation (adding 1160 man-hours in winter	NA	0	2.55	CY	$0.00
Decommissioning with	Monitor well	3	7	220.00	ea	$1,540.00
Implementation	Permanently installed probe		32	110.00	ea	$3,520.00
Dispose Non-spec Soil at	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
Fort Wainwright Landfill	Hauling excavation to Fort Wainwright Landfill (expanded volume)		0	5.25	CY	$0.00
	Disposal (expanded Volume)		0	0.00	CY	$0.00
	Confirmatory soil sample analysis- excavation (max. 1 sample/200 CY excavated)		0	300.00	ea	$0.00
	Import and place clean fill (expanded volume)		0	2.99	CY	$0.00
Decommissioning at End of	Well (monitoring, SVE, or sparge) removal	30	8	220.00	ea	$1,760.00
Cleanup Action	Permanently installed probe removal		0	110.00	ea	$0.00
	Underground piping removal, trench backfill, haul and dispose at FW landfill		0	2.00	LF	$0.00
	Engineered pile/landfarm deconstruction and stockpiling treated soil		0	10.00	CY	$0.00
	Hauling treated soil to placement area		0	5.25	CY	$0.00
	Fan house decommissioning and removal		0	1,700.00	ea	$0.00
	Site restoration		0		LS	$0.00
	Confirmatory soil sample analysis- treated soils (1 sample/200 CY treated soil)		0		ea	$0.00
Totals	Year	3				$10,960.00
	Year	30				$1,760.00

CY: cubic yard
DC: direct capital cost
ea: each
FW: Fort Wainwright
hr: hour
LF: linear feet
LS: lump sum
LTTD: low temperature thermal desorption
NA: not applicable for this alternative
PVC: polyvinyl chloride
SF: square feet
SY: square yard
SVE: soil vapor extraction

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - DRMO - Alternative No. 2
Institutional Controls and Natural Attenuation

Indirect Capital Cost Detail

Item		Year of IC Expenditure	Quantity	Rate	Units	Cost	
Engineering: Design to Implementation		0					
	Administration and supervision		40	85.00	hr	$3,400	
	Design and development		80	75.00	hr	$6,000	
	Drafting		32	65.00	hr	$2,080	
	Monitoring and testing (Year 0)		0	65.00	hr	$0	
	Project engineering		24	65.00	hr	$1,560	
Subtotal							*$13,040*
Engineering : Decommissioning		30					
	Administration and supervision		20	85.00	hr	$1,700	
	Design and development		40	75.00	hr	$3,000	
	Drafting		8	65.00	hr	$520	
	Monitoring and testing		0	65.00	hr	$0	
	Project engineering		40	65.00	hr	$2,600	
Subtotal							*$7,820*
License/Permit/Legal	(10% engineering costs)	0	1	2,086.00	ea	$2,086	*$2,086*
Start-up and Shake Down of Treatment System		NA					
	Materials		0	1,000.00	ea	$0	
	Labor		0	65.00	hr	$0	
	Equipment		0	1,000.00	ea	$0	
	Lab Testing		0	500.00	ea	$0	
Subtotal							*$0*
Contingency	(15% capital costs)	0	1	5,349.90	LS	$5,350	*$5,350*
Total	**Year**	**0**					**$20,476**
	Year	**30**					**$7,820**

ea: each

hr: hour

IC: indirect capital cost

LS: lump sum

NA: not applicable for this alternative

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - DRMO - Alternative No.2
Institutional Controls and Natural Attenuation

Annual System Operation Cost Detail

Item		Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Total/year
Operating Labor Cost					1/Year		
(Post-Construction)	Item 1: Groundwater monitoring	40	65.00	hr		1 to 30	$2,600
	Item 2: Training	1	200.00	LS		1 to 30	$200
Subtotal							*$2,800*
Routine Maintenance Materials and Labor Cost					1/Year		
	Item 1: Groundwater monitoring annual maintenance	1	1,000.00	LS		1 to 30	$1,000
	Item 2: SVE/air sparge well annual maintenance	0		LS			$0
	Item 3: Sampling field kit	2	75.00	day		1 to 30	$150
Subtotal							*$1,150*
Auxiliary Materials and Energy						NA	
	Process Chemicals	0		LS			$0
	Electricity	0		LS			$0
	Water	0		LS			$0
	Sewer	0		LS			$0
	Fuel	0		LS			$0
Subtotal							*$0*
Disposal of Residues					1/Year		
	Wash water, sludge, ect.	1	500.00	LS		1 to 30	$500
Subtotal							*$500*
Purchased Services					1/Year		
	Professional Services						
	Item 1: Laboratory Fees	8	625.00	well		1 to 30	$5,000
	Item 2:	0		LS			$0
	Item 3:	0		LS			$0
Subtotal							*$5,000*
Other:					1/Year		
Administratve costs not included in other line items		0		LS			$0
Insurance		0	0.00	LS			$0
Taxes, licensing, permit renewal		0	0.00	LS			$0
Maintenance Reserve Fund							
(5% of capital costs prorated for each year of implementation)		1	68.36	LS		1 to 30	$68
Subtotal							*$68*
Total Annual Operating Cost						**1 to 30**	**$9,518**

Number of years of implementation: 30

AOC: annual operating cost
hr: hour
LS: lump sum
NA: not applicable for this alternative
SVE: soil vapor extraction

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - DRMO - Alternative No. 3
Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

Direct Capital Cost - Detail

	Item	Year of DC Expenditure	Quantity	Rate	Unit	Total
Sparge/Biosparge Wells	Well installation (50-foot, 1 1/4" diameter, black iron, screen wells)	0	62	1,486.95	ea	$92,190.90
	Trenching to fan house (50', 2' deep- average for each well, incl. backfill)		62	120.25	ea	$7,455.50
	Manhole with cover (one per well)		62	646.50	ea	$40,083.00
	Piping to fanhouse (50' average for each well) with pipe insulation and heat trace		62	850.15	ea	$52,709.30
	Valves and fittings for each run of piping		62	150.00	ea	$9,300.00
	Biosparge treatability test		0	10,000.00	ea	$0.00
SVE/Biovent Wells	Well installation (20 foot, 4" diameter, PVC, super rip-rustated wells)	0	21	2,200.00	ea	$46,200.00
	Trenching to fan house (50', 2' deep- average for each well, incl. backfill)		21	120.25	ea	$2,525.25
	Manhole with cover (one per well)		21	646.50	ea	$13,576.50
	Piping to fanhouse (50' average for each well) with pipe insulation and heat trace		21	850.15	ea	$17,853.15
	Valves and fittings for each run of piping		21	150.00	LS	$3,150.00
	Asphalt surface cover to minimize short-circuiting and protect piping from traffic		25,000	8.47	SY	$211,750.00
	Biovent treatability test		0	10,000.00	LS	$0.00
SVE/Sparge Fan House	Prefab housing	0	10	5,000.00	ea	$50,000.00
	Injection blower		10	9,051.00	ea	$90,510.00
	Water separator		10	1,293.00	ea	$12,930.00
	Mist eliminator		10	1,293.00	ea	$12,930.00
	Duct heater		10	2,133.45	ea	$21,334.50
	Extraction blower		10	9,051.00	ea	$90,510.00
	Condensate receiver		10	1,293.00	ea	$12,930.00
	Unit heater		10	523.67	ea	$5,236.70
	Dome heater with bird screen		10	27.80	ea	$278.00
	Exhaust Controls		10	10,344.00	ea	$103,440.00
	Instrumentation (pressure, flow)		10	4,848.75	LS	$48,487.50
	Sampling ports		10	387.90	LS	$3,879.00
	Plumbing and electrical hook-up		10	1,000.00	ea	$10,000.00
	Equipment controls		10	2,876.93	ea	$28,769.30
	Electrical hook-up		10	1,000.00	ea	$10,000.00
	Lighting		10	200.42	ea	$2,004.20
LTTD Treatment	LTTD processing (expanded volume)	NA	0	96.98	CY	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Hauling excavation to/from treatment facility (expanded volume)		0	5.25	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Backfill treated soil in original excavation (expanded volume)		0	2.57	CY	$0.00
	Dispose of treated soil at FW landfill (expanded volume)		0	0.00	CY	$0.00
	Import & backfill clean fill in dispose of treated soils at FW landfill (expanded volume)		0	2.99	CY	$0.00
Capping	Cap install	NA	0	1.19	SF	$0.00
Solidification (portland cement)	Mix design/treatability testing		0	35,000.00	LS	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Mixing, placing		0	193.95	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	600.00	ea	$0.00
Engineered Pile- Biopile	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Treatability testing		0	10,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Engineered Pile- SVE Pile	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Offgas treatment unit		0	10,344.00	LS	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Landfarming	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	9.70	CY	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Monitoring Well Installation	Well installation and development (25-foot, 4" diameter, PVC super rip-rustated wells)	2	2	2,950.00	ea	$5,900.00
Excavation Shoring	Shoring installation and removal in water to depth of 19 feet	NA	0	27.80	LF	$0.00
Fencing and Sign Posting	6 foot chain link with high-visibility signs	NA	0	16.47	LF	$0.00
Premium for Winter Excavation	Premium for winter excavation (building 1168 low-water in winter)	NA	0	2.55	CY	$0.00
Decommissioning at Implementation	Monitor well	0	7	220.00	ea	$1,540.00
	Permanently installed probe		32	110.00	ea	$3,520.00
Dispose non-spec Soil at Fort Wainwright Landfill	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Hauling excavation to Fort Wainwright Landfill (expanded volume)		0	5.25	CY	$0.00
	Disposal (expanded Volume)		0	0.00	CY	$0.00
	Confirmatory soil sample analytical- excavation (rush, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
	Import and place clean fill (expanded volume)		0	2.99	CY	$0.00
Decommissioning at End of Cleanup Action	Well monitoring, SVE, air sparge) removal	15	110	220.00	ea	$24,200.00
	Permanently installed probe removal		0	110.00	ea	$0.00
	Underground piping removal, trench backfill, haul and dispose at FW landfill		5,000	2.00	LF	$10,000.00
	Engineered pile/landfarm deconstruction and stockpiling treated soil		0	10.00	CY	$0.00
	Hauling treated soil to placement area		0	5.25	CY	$0.00
	Fan house decommissioning and removal		10	1,700.00	ea	$17,000.00
	Site restoration		1	10,000.00	LS	$10,000.00
	Confirmatory soil sample analytical- treated soils (1 sample/200 CY treated soil)	15	620.00	ea	$9,300.00
Totals	Year	0				$1,818,892.80
	Year	15				$78,500.00

CY: cubic yard
DC: direct capital cost
ea: each
FW: Fort Wainwright
hr: hour
LF: linear foot
LS: lump sum
LTTD: low temperature thermal desorption
NA: not applicable for this alternative
PVC: polyvinyl chloride
SF: square foot
SY: square yard
SVE: soil vapor extraction

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - DRMO - Alternative No. 3
Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

Indirect Capital Cost Detail

Item		Year of IC Expenditure	Quantity	Rate	Units	Cost	
Engineering: Design to Implementation		0					
	Administration and supervision		320	85.00	hr	$27,200	
	Design and development		640	75.00	hr	$48,000	
	Drafting		240	65.00	hr	$15,600	
	Monitoring and testing (Year 0)		0	65.00	hr	$0	
	Project engineering		280	65.00	hr	$18,200	
Subtotal							*$109,000*
Engineering : Decommissioning		15					
	Administration and supervision		60	85.00	hr	$5,100	
	Design and development		160	75.00	hr	$12,000	
	Drafting		40	65.00	hr	$2,600	
	Monitoring and testing		0	65.00	hr	$0	
	Project engineering		138	65.00	hr	$8,970	
Subtotal							*$28,670*
License/Permit/Legal	(10% engineering costs)	0	1	13,767.00	ea	$13,767	*$13,767*
Start-up and Shake Down of Treatment System		0					
	Materials		6	1,000.00	ea	$6,000	
	Labor		240	65.00	hr	$15,600	
	Equipment		6	1,000.00	ea	$6,000	
	Lab Testing		48	500.00	ea	$24,000	
Subtotal							*$51,600*
Contingency	(15% capital costs)	0	1	226,142.41	LS	$226,142	*$226,142*
Total	**Year**	**0**					**$400,509**
	Year	**15**					**$28,670**

ea: each

hr: hour

IC: indirect capital cost

LS: lump sum

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - DRMO - Alternative No.3
Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

Annual System Operation Cost Detail

Item		Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Total/year
Operating Labor Cost					1/year		
(Post-Construction)	Item 1: Groundwater monitoring	40	65.00	hr		1 to 15	$2,600
	Item 2: SVE/AS system monitoring	208	65.00	*hr*		1 to 10	$13,520
	Item 3: Training	1	400.00	LS		1 to 15	$400
Subtotal						*1 to 15*	*$3,000*
						1 to 10	*$13,520*
Routine Maintenance Materials and Labor Cost					1/year		
	Item 1: *Groundwater monitoring annual maintenance*	1	1,000.00	LS		1 to 15	$1,000
	Item 2: SVE/air sparge system annual maintenance	1	1,000.00	LS		1 to 10	$1,000
	Item 3: Sampling field kit	2	75.00	day		1 to 15	$150
Subtotal						*1 to 15*	*$1,150*
						1 to 10	*$1,000*
Auxiliary Materials and Energy					1/year		
	Process Chemicals	0		LS			$0
	Electricity (Phase 1)	1	152,000.00	LS		1 to 3	$152,000
	Electricity (Phase 2)	1	14,200.00	LS		4 to 10	$14,200
	Water	0		LS			$0
	Sewer	0		LS			$0
	Fuel	1	400.00	LS		1 to 15	$400
Subtotal						*1 to 15*	*$400*
						4 to 10	*$14,200*
						1 to 3	*$152,000*
Disposal of Residues					1/year		
	Wash water, sludge, ect.	1	500.00	LS		1 to 15	$500
Subtotal						*1 to 15*	*$500*
Purchased Services					1/year		
Professional Services							
	Item 1: Laboratory Fees	8	625.00	well		1 to 15	$5,000
	Item 2: Engineer review/ consultation	12	130.00	month		1 to 15	$1,560
	Item 3:	0		LS			$0
Subtotal						*1 to 15*	*$6,560*
Other:					1/year		
Administrative costs not included in other line items		0		LS			$0
Insurance		0		LS			$0
Taxes, licensing, permit renewal		0		LS			$0
Maintenance Reserve Fund							
5% of capital costs prorated for each year of implementation		1	5,779.19	LS		1 to 15	$5,779
Subtotal						*1 to 15*	*$5,779*
Total Annual Operating Cost (includes GW Monitoring)						**1 to 3**	**$183,909**
						4 to 10	**$46,109**
						11 to 15	**$17,389**
Groundwater Monitoring Portion Of Total AOC						1 to 15	$8,600

Number of years of implementation: 15

AOC: annual operating cost
AS: air sparge
hr: hour
LS: *lump sum*
SVE: soil vapor extraction
GW: groundwater

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - ORMO - Alternative No. 4
Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene
and Disposal at the Fort Wainwright Landfill

Direct Capital Cost - Detail

Item		Year of DC Expenditure	Quantity	Rate	Unit	Total
Sparge/Biosparge Wells	Well installation 50 feet, 1 1/4" diameter, steel pipe, screen wells)	0	62	1,486.95	ea	$92,190.90
	Trenching to fan house (50', 2' deep- average for each well, excl. backfill)		62	120.25	ea	$7,455.50
	Manhole with cover (one per well)		62	646.50	ea	$40,083.00
	Piping to fanhouse (50' average for each well- with pipe excavation and sand trace		62	850.15	ea	$52,709.30
	Valves and fittings for each run of piping		62	150.00	ea	$9,300.00
	Biosparge treatability test		0	10,000.00	ea	$0.00
SVE/Biovent Wells	Well installation (20 feet, 4" diameter, PVC, auger rig-excluded wells)	0	21	2,200.00	ea	$46,200.00
	Trenching to fan house (50', 2' deep- average for each well, excl. backfill		21	120.25	ea	$2,525.25
	Manhole with cover (one per well)		21	646.50	ea	$13,576.50
	Piping to fanhouse (50' average for each well- with pipe excavation and sand trace		21	850.15	ea	$17,853.15
	Valves and fittings for each run of piping		21	150.00	LS	$3,150.00
	Asphalt surface cover to maximize short-circuiting and protect piping from traffic		25,000	8.47	SY	$211,750.00
	Biovent treatability test		0	10,000.00	LS	$0.00
SVE/Sparge Fan house	Prefab housing	0	10	5,000.00	ea	$50,000.00
	Injection blower		10	9,051.00	ea	$90,510.00
	Water separator		10	1,293.00	ea	$12,930.00
	Mist eliminator		10	1,293.00	ea	$12,930.00
	Duct heater		10	2,133.45	ea	$21,334.50
	Extraction blower		10	9,051.00	ea	$90,510.00
	Condensate receiver		10	1,293.00	ea	$12,930.00
	Unit heater		10	523.67	ea	$5,236.70
	Door louver with bird screen		10	27.80	ea	$278.00
	Exhaust Controls		10	10,344.00	ea	$103,440.00
	Instrumentation (pressure, flow)		10	4,848.75	LS	$48,487.50
	Sampling ports		10	387.90	LS	$3,879.00
	Plumbing and electrical hook-up		10	1,000.00	ea	$10,000.00
	Equipment controls		10	2,876.93	ea	$28,769.30
	Electrical hook-up		10	1,000.00	ea	$10,000.00
	Lighting		10	200.42	ea	$2,004.20
LTTD Treatment	LTTD processing (expansion volume)	NA	0	96.98	CY	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Hauling excavation to/from treatment facility (expanded volume)		0	5.25	CY	$0.00
	Confirmatory soil sample analytical- excavation (rock, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Backfill treated soil in original excavation (expanded volume)		0	2.57	CY	$0.00
	Dispose of treated soil at FW landfill (expanded volume)		0	0.00	CY	$0.00
	Import & backfill clean fill of dispose of treated soils at FW landfill (expanded volume)		0	2.99	CY	$0.00
Capping	Cap install	NA	0	1.19	SF	$0.00
Solidification (portland cement)	Mix design/treatability testing		0	35,000.00	LS	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Mixing, placing		0	193.95	CY	$0.00
	Confirmatory soil sample analytical- excavation (rock, 1 sample/200 CY excavated)		0	600.00	ea	$0.00
Engineered Pile- Grass	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Treatability testing		0	10,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rock, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Engineered Pile- Silt Fill	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Offgas treatment cost		0	10,344.00	LS	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rock, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Landfarming	Excavation (in-place volume)	NA	0	2.55	CY	$0.00
	Construction and treatment		0	9.70	CY	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation (rock, 1 sample/200 CY excavated)		0	300.00	ea	$0.00
Monitoring well installation	Well installation and development (25 feet, 4" diameter PVC, auger rig-excluded wells)	0	2	2,950.00	ea	$5,900.00
Excavation Shoring	Shoring installation and removal in center to depth of 15 feet	NA	0	27.80	LF	$0.00
Fencing and Sign Posting	6 foot chain link with high visibility signs	NA	0	16.47	LF	$0.00
Premium for Winter Excavation	Premium for winter excavation (Building 1763 low-water in winter)	NA	0	2.55	CY	$0.00
Decommissioning of monitoring wells	Monitor well	0	7	220.00	ea	$1,540.00
	Permanently installed probe		32	110.00	ea	$3,520.00
Dispose Hot Spot Soil at Fort Wainwright Landfill	Excavation (in-place volume)	0	1,900	2.55	CY	$4,845.00
	Hauling excavation to Fort Wainwright Landfill (expansion volume)		2,280	5.25	CY	$11,970.00
	Disposal (expanded Volume)		2,280	0.00	CY	$0.00
	Confirmatory soil sample analytical- excavation (rock, 1 sample/200 CY excavated)		10	300.00	ea	$3,000.00
	Import and place clean fill (expanded volume)		2,280	2.99	CY	$6,817.20
Decommissioning at End of Cleanup Action	Well (monitoring, SVE, air sparge) removal	15	110	220.00	ea	$24,200.00
	Permanently installed probe removal		0	110.00	ea	$0.00
	Underground piping removal, trench backfill, haul and disposal at FW landfill		5,000	2.00	LF	$10,000.00
	Engineered pile/landfarm deconstruction and stockpiling treated soil		0	10.00	CY	$0.00
	Hauling treated soil to placement area		0	5.25	CY	$0.00
	Fan house decommissioning and removal		10	1,700.00	ea	$17,000.00
	Site restoration		1	10,000.00	LS	$10,000.00
	Confirmatory soil sample analytical		15	620.00	ea	$9,300.00
Totals		Year 0	0			$1,037,625.00
		Year 15	15			$79,500.00

CY: cubic yard
DC: direct capital cost
ea: each
FW: Fort Wainwright
hr: hour
LF: linear foot
LS: lump sum
LTTD: low temperature thermal desorption
NA: not applicable for this alternative
PVC: polyvinyl chloride
SF: square foot
SY: square yard
SVE: soil vapor extraction

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - DRMO - Alternative No. 4
Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and Disposal at the Fort Wainwright Landfill

Indirect Capital Cost Detail

Item		Year of IC Expenditure	Quantity	Rate	Units	Cost	
Engineering: Design to implementation		0					
	Administration and supervision		320	85.00	hr	$27,200	
	Design and development		720	75.00	hr	$54,000	
	Drafting		288	65.00	hr	$18,720	
	Monitoring and testing (Year 0)		0	65.00	hr	$0	
	Project engineering		640	65.00	hr	$41,600	
Subtotal							*$141,520*
Engineering : Decommissioning		15					
	Administration and supervision		80	85.00	hr	$6,800	
	Design and development		160	75.00	hr	$12,000	
	Drafting		48	65.00	hr	$3,120	
	Monitoring and testing		0	65.00	hr	$0	
	Project engineering		120	65.00	hr	$7,800	
Subtotal							*$29,720*
License/Permit/Legal	(10% engineering costs)	0	1	17,124.00	ea	$17,124	*$17,124*
Start-up and Shake Down of Treatment System		0					
	Materials		6	1,000.00	ea	$6,000	
	Labor		240	65.00	hr	$15,600	
	Equipment		6	1,000.00	ea	$6,000	
	Lab Testing		48	500.00	ea	$24,000	
Subtotal							*$51,600*
Contingency	(15% capital costs)	0	1	202,213.35	LS	$202,213	*$202,213*
Total	**Year**	**0**					**$412,457**
	Year	**15**					**$29,720**

ea: each

hr: hour

IC: indirect capital cost

LS: lump sum

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - DRMO - Alternative No.4
Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and Disposal at the Fort Wainwright Landfill

Annual System Operation Cost Detail

Item		Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Total/year
Operating Labor Cost					1/year		
(Post-Construction)	Item 1: Groundwater monitoring	40	65.00	hr		1 to 15	$2,600
	Item 2: SVE/AS system monitoring	208	65.00	hr		1 to 10	$13,520
	Item 3: Training	1	400.00	LS		1 to 15	$400
Subtotal						*1 to 15*	*$3,000*
						1 to 10	*$13,520*
Routine Maintenance Materials and Labor Cost					1/year		
	Item 1: Groundwater monitoring annual maintenance	1	1,000.00	LS		1 to 15	$1,000
	Item 2: SVE/air sparge system annual maintenance	1	1,000.00	LS		1 to 10	$1,000
	Item 3: Sampling field kit	2	75.00	day		1 to 15	$150
Subtotal						*1 to 15*	*$1,150*
						1 to 10	*$1,000*
Auxiliary Materials and Energy					1/year		
	Process Chemicals	0		LS			$0
	Electricity (Phase 1)	1	152,000.00	LS		1 to 3	$152,000
	Electricity (Phase 2)	1	14,200.00	LS		4 to 10	$14,200
	Water	0		LS			$0
	Sewer	0		LS			$0
	Fuel	1	400.00	LS		1 to 15	$400
Subtotal						*1 to 15*	*$400*
						4 to 10	*$14,200*
						1 to 3	*$152,000*
Disposal of Residues					1/year		
	Wash water, sludge, ect.	1	500.00	LS		1 to 15	$500
Subtotal						*1 to 15*	*$500*
Purchased Services					1/year		
Professional Services							
	Item 1: Laboratory Fees	8	625.00	well		1 to 15	$5,000
	Item 2: Engineer review/ consultation	12	130.00	month		1 to 15	$1,560
	Item 3:	0		LS			$0
Subtotal						*1 to 15*	*$6,560*
Other:					1/year		
Administrative costs not included in other line items		0		LS			$0
Insurance		0		LS			$0
Taxes, licensing, permit renewal		0		LS			$0
Maintenance Reserve Fund							
(5% of capital costs prorated for each year of implementation)		1	5,167.67	LS		1 to 15	$5,168
Subtotal						*1 to 15*	*$5,168*
Total Annual Operating Cost (includes GW Monitoring)						**1 to 3**	**$183,298**
						4 to 10	**$45,498**
						11 to 15	**$16,778**
Groundwater Monitoring Portion Of Total AOC						1 to 15	$8,600

Number of years of implementation: 15

AOC: annual operating cost
AS: air sparge
ea: each
hr: hour
SVE: soil vapor extraction
GW: groundwater

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - ORMO - Alternative No. 5
Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene
and On-site Solidification

Direct Capital Cost - Detail

Item		Year of DC Expenditure	Quantity	Cost	Unit	Total
Sparge/Biosparge Wells	Well installation (50-foot, 1 1/4" diameter, direct push, driven wells)	0	62	1,484.85	ea	$92,190.90
	Trenching to fan house (50', 2' deep- average for each well, excl. backfill)		62	129.25	ea	$7,455.50
	Manhole with cover (one per well)		62	646.50	ea	$40,083.00
	Piping to fanhouse (50' average for each well; with pipe insulation and heat trace		62	850.15	ea	$52,709.38
	Valves and fittings for each run of piping		62	150.00	ea	$9,300.00
	Biosparge treatability test		1	10,000.00	ea	$0.00
SVE Bennett Wells	Well installation (20 feet, 4" diameter, PVC, auger rig-installed wells)	0	21	2,200.00	ea	$46,200.00
	Trenching to fan house (50', 2' deep- average for each well, excl. backfill)		21	129.25	ea	$2,525.25
	Manhole with cover (one per well)		21	646.50	ea	$13,576.50
	Piping to fanhouse (50' average for each well; with pipe insulation and heat trace		21	850.15	ea	$17,853.15
	Valves and fittings for each run of piping		21	150.00	LS	$3,150.00
	Asphalt surface cover to overcome short-circuiting and protect piping from traffic		25,000	1.47	SY	$211,750.00
	Bennett treatability test		0	10,000.00	LS	$0.00
SVE Sparge Fan House	Prefab housing	0	1	5,000.00	ea	$50,000.00
	Injection blower		10	9,051.00	ea	$90,510.00
	Water separator		10	1,293.00	ea	$12,930.00
	Mist eliminator		10	1,293.00	ea	$12,930.00
	Duct heater		10	2,133.45	ea	$21,334.50
	Extraction blower		10	9,051.00	ea	$90,510.00
	Condensate receiver		10	1,293.00	ea	$12,930.00
	Unit heater		10	523.67	ea	$5,236.70
	Door louver with bird screen		10	27.80	ea	$278.00
	Exhaust Controls		10	10,344.00	ea	$103,440.00
	Instrumentation (pressure, flow)		10	4,848.75	LS	$48,487.50
	Sampling ports		10	387.80	LS	$3,878.00
	Plumbing and electrical hook-up		10	1,000.00	ea	$10,000.00
	Equipment controls		10	2,878.93	ea	$28,789.30
	Electrical hook-up		10	1,000.00	ea	$10,000.00
	Lighting		10	200.42	ea	$2,004.20
LTTD Treatment	LTTD processing (expanded volume)	NA	1	96.98	CY	$0.00
	Excavation (in-place volume)		0	2.55	CY	$0.00
	Hauling excavation to/from treatment facility (expanded volume)		0	5.25	CY	$0.00
	Confirmatory soil sample analytical- excavation areas, 1 sample/200 CY excavated		0	300.00	ea	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Backfill treated soil in original excavation (expanded volume)		0	2.57	CY	$0.00
	Dispose of treated soil at FW landfill (expanded volume)		0	0.00	CY	$0.00
	Import & backfill clean fill if dispose of treated soils at FW landfill (expanded volume)		0	2.99	CY	$0.00
Capping	Cap install	NA	1	1.19	SF	$0.00
Solidification (portland cement)	Mix design/treatability testing	0	1	25,000.00	LS	$25,000.00
	Excavation (in-place volume)		1900	2.55	CY	$4,845.00
	Mixing, placing		2288	193.95	CY	$443,706.00
	Confirmatory soil sample analytical- excavation areas, 1 sample/200 CY excavated		10	300.00	ea	$3,000.00
Engineered Pile- Biopile	Excavation (in-place volume)	NA	1	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Treatability testing		0	10,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation areas, 1 sample/200 CY excavated		0	300.00	ea	$0.00
Engineered Pile- SVE Pile	Excavation (in-place volume)	NA	1	2.55	CY	$0.00
	Construction and treatment		0	32.33	CY	$0.00
	Offgas treatment unit		0	10,344.00	LS	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation areas, 1 sample/200 CY excavated		0	300.00	ea	$0.00
Landfarming	Excavation (in-place volume)	NA	1	2.55	CY	$0.00
	Construction and treatment		0	9.70	CY	$0.00
	Treatability testing		0	5,000.00	LS	$0.00
	Confirmatory soil sample analytical- excavation areas, 1 sample/200 CY excavated		0	300.00	ea	$0.00
Monitoring Well Installation	Well installation and development (25-feet, 4" diameter PVC, auger rig-installed wells)	0	1	2,950.00	ea	$15,900.00
Excavation Shoring	Shoring installation and removal in trench to depth of >20 feet	NA	1	2.80	LF	$0.00
Fencing and Sign Posting	6 foot chain link with high visibility signs	NA	1	9.87	LF	$0.00
Premium for Winter Excavation	Premium for winter excavation (Building TTES dew-evator in winter)	NA	1	2.55	CY	$0.00
Decommissioning at Implementation	Monitor well	0	1	225.00	ea	$1,540.00
	Permanently installed probe		32	110.00	ea	$3,520.00
Disposal Hot-spot Soil at	Excavation (in-place volume)	NA	1	2.55	CY	$0.00
Fort Wainwright Landfill	Hauling excavation to Fort Wainwright Landfill (expanded volume)		2	5.25	CY	$0.00
	Disposal (expanded Volume)		0	0.00	CY	$0.00
	Confirmatory soil sample analytical- excavation areas, 1 sample/200 CY excavated		2	300.00	ea	$0.00
	Import and place clean fill (expanded volume)		2	2.99	CY	$0.00
Decommissioning at End of Cleanup Action	Well (monitoring, SVE, air sparge) removal	15	11	225.00	ea	$22,440.00
	Permanently installed probe removal		0	110.00	ea	$0.00
	Underground piping removed, trench backfill, haul and dispose at FW landfill	15	5,000	2.00	LF	$10,000.00
	Engineered pile/landfarm deconstruction and stockpiling treated soil		0	10.00	CY	$0.00
	Hauling treated soil to placement area		0	5.25	CY	$0.00
	Fan house decommissioning and removal	15	10	1,700.00	ea	$17,000.00
	Site restoration	15	1	10,000.00	LS	$10,000.00
	Confirmatory saturated soil sample analytical	15	15	620.00	ea	$9,300.00
	Confirmatory soil sample analytical- treated soils (1 sample/200 CY treated soil)	30	8	220.00	ea	$1,760.00
Totals	Year	0				$1,496,943.80
	Year	15				$68,748.80
	Year	30				$1,760.00

CY: cubic yard
DC: direct capital cost
ea: each
FW: Fort Wainwright
hr: hour
LF: linear foot
LS: lump sum
LTTD: low temperature thermal desorption
NA: not applicable for this alternative
PVC: polyvinyl chloride
SF: square foot
SY: square yard
SVE: soil vapor extraction

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - DRMO - Alternative No. 5
Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and On-site Solidification

Indirect Capital Cost Detail

Item		Year of IC Expenditure	Quantity	Rate	Units	Cost	
Engineering: Design to Implementation		0					
	Administration and supervision		360	85.00	hr	$30,600	
	Design and development		800	75.00	hr	$60,000	
	Drafting		336	65.00	hr	$21,840	
	Monitoring and testing (Year 0)		65	300.00	ea	$19,500	
	Project engineering		560	65.00	hr	$36,400	
Subtotal							*$168,340*
Engineering : Decommissioning							
	Administration and supervision	15	80	85.00	hr	$6,800	
	Design and development	15	160	75.00	hr	$12,000	
	Drafting	15	48	65.00	hr	$3,120	
	Monitoring and testing		0	65.00	hr	$0	
	Project engineering	15	120	65.00	hr	$7,800	
	Project engineering	30	80	65.00	hr	$5,200	
Subtotal						*Year 15*	*$29,720*
						Year 30	*$5,200*
License/Permit/Legal	(10% engineering costs)	0	1	20,326.00	ea	$20,326	*$20,326*
Start-up and Shake Down of Treatment System		0					
	Materials		6	1,000.00	ea	$6,000	
	Labor		240	65.00	ea	$15,600	
	Equipment		6	1,000.00	ea	$6,000	
	Lab Testing		48	500.00	ea	$24,000	
Subtotal							*$51,600*
Contingency	(15% capital costs)	0	1	276,259.47	LS	$276,259	*$276,259*
	Year	0					$516,525
Total	Year	15					$29,720
	Year	30					$5,200

ea: each

hr: hour

IC: indirect capital cost

LS: lump sum

Fort Wainwright OU-2 Feasibility Study
Baseline Cost Estimate - DRMO - Alternative No. 5
Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and On-site Solidification

Annual System Operation Cost Detail

Item		Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Total/year
Operating Labor Cost					1/year		
(Post-Construction)	Item 1: Groundwater monitoring	40	65.00	hr		1 to 30	$2,600
	Item 2: SVE/AS system monitoring	208	65.00	hr		1 to 10	$13,520
	Item 3: Training	1	400.00	LS		1 to 30	$400
Subtotal						*1 to 30*	*$3,000*
						1 to 10	*$13,520*
Routine Maintenance Materials and Labor Cost					1/year		
	Item 1: Groundwater monitoring annual maintenance	1	1,000.00	LS		1 to 30	$1,000
	Item 2: SVE/air sparge system annual maintenance	1	1,000.00	LS		1 to 10	$1,000
	Item 3: Sampling field kit	2	75.00	day		1 to 30	$150
Subtotal						*1 to 30*	*$1,150*
						1 to 10	*$1,000*
Auxiliary Materials and Energy					1/year		
	Process Chemicals	0		LS			$0
	Electricity (Phase 1)	1	152,000.00	LS		1 to 3	$152,000
	Electricity (Phase 2)	1	14,200.00	LS		4 to 10	$14,200
	Water	0		LS			$0
	Sewer	0		LS			$0
	Fuel	1	400.00	LS		1 to 30	$400
Subtotal						*1 to 30*	*$400*
						4 to 10	*$14,200*
						1 to 3	*$152,000*
Disposal of Residues					1/year		
	Wash water, sludge, ect.	1	500.00	LS		1 to 30	$500
Subtotal						*1 to 30*	*$500*
Purchased Services					1/year		
Professional Services							
	Item 1: Laboratory Fees	8	625.00	well		1 to 30	$5,000
	Item 2: Engineer review/ consultation	12	130.00	month		1 to 30	$1,560
	Item 3:	0		LS			$0
Subtotal						*1 to 30*	*$6,560*
Other:					1/year		
Administrative costs not included in other line items		0		LS			
Insurance		0		LS			
Taxes, licensing, permit renewal		0		LS			
Maintenance Reserve Fund							
(5% of capital costs prorated for each year of implementation)		1	3,529.98	LS		1 to 30	$3,530
Subtotal						*1 to 30*	*$3,530*
Total Annual Operating Cost (includes GW Monitoring)						**1 to 3**	**$181,660**
						4 to 10	**$43,860**
						11 to 30	**$15,140**
Groundwater Monitoring Portion Of Total AOC						1 to 30	$8,600

Number of years of implementation: 30

AOC: annual operating cost
AS: air sparge
hr: hour
LS: lump sum
SVE: soil vapor extraction
GW: groundwater